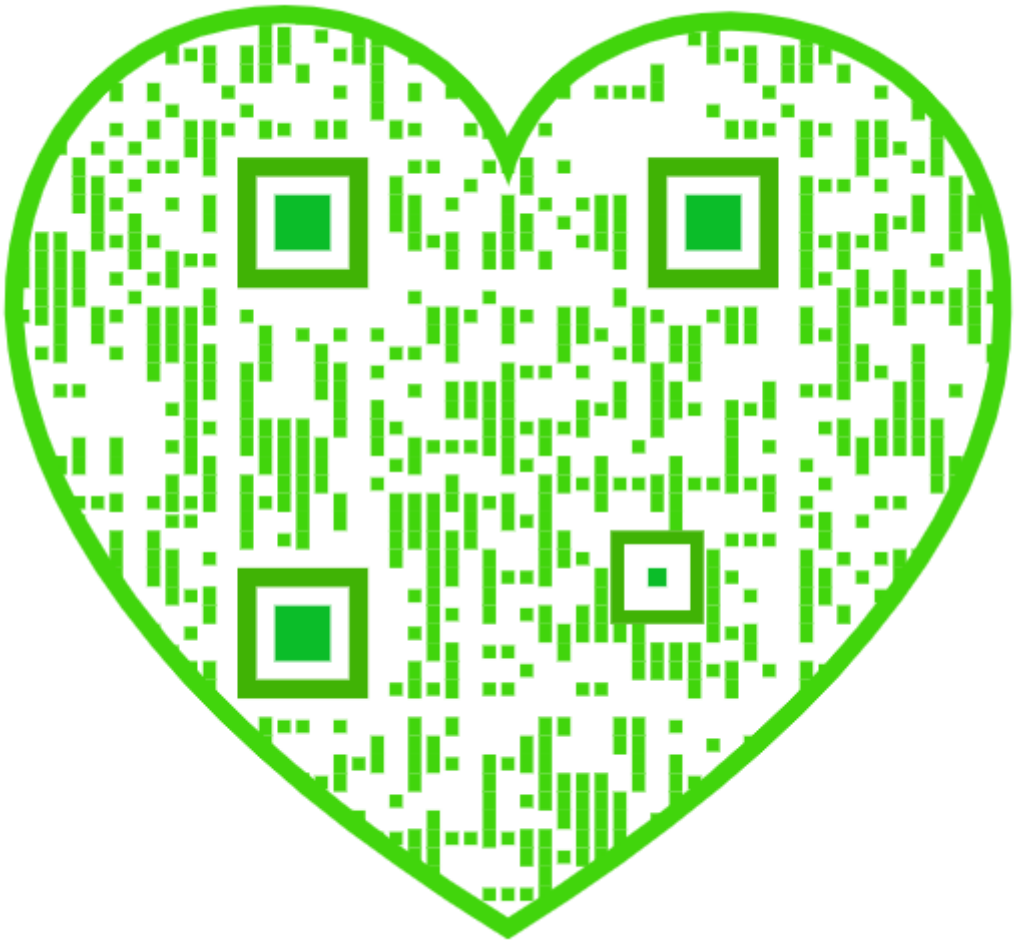

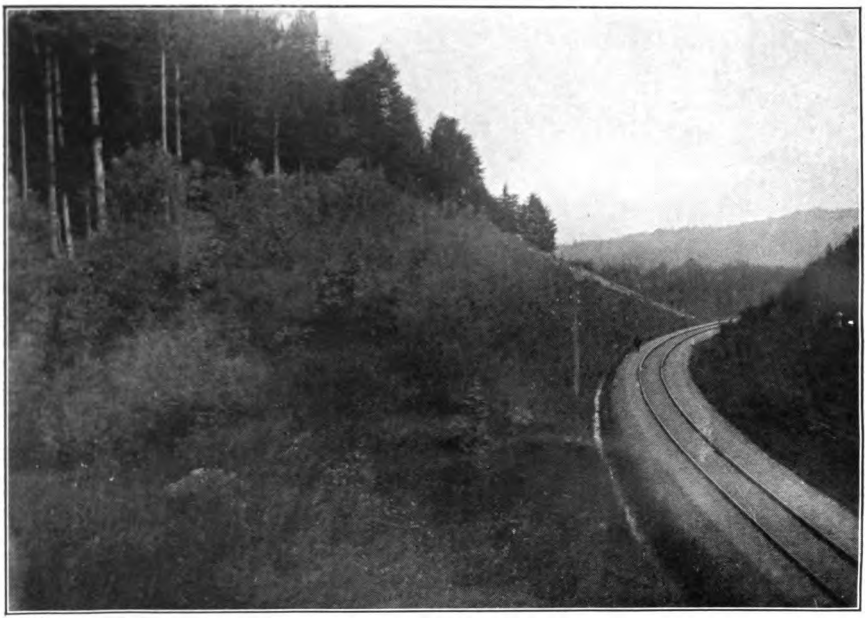

In the Black Forest near the City of Freudenstadt in western part of Wurtemberg, Germany. Railroad right-of-way planted with maple and locust trees to guard against setting fire by sparks from locomotives. These woods on the right-of-way are cleared twice a year of combustible material such as sticks, leaves, etc.

Forest scenery along the St. Paul & Duluth (now Northern Pacific) Railroad, ruined by forest fires in 1894 or previously. Photographed in 1899 for the annual report of the Chief (Forest) Fire Warden of Minnesota.

FORESTRY

NINTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF

MINNESOTA

UNDER THE ACT OF THE LEGISLATURE ENTITLED
"AN ACT TO PROVIDE FOR THE PRESERVATION OF FORESTS OF THIS STATE AND FOR THE PREVENTION AND SUPPRESSION OF FOREST AND PRAIRIE FIRES,"
APPROVED APRIL 18, 1895, AND AS AMENDED BY
THE ACT OF APRIL 21, 1903

FOR THE YEAR 1903.

ST. PAUL, MINN.:
PRINTED BY THE PIONEER PRESS COMPANY.
1904.

THE
OF

STATE OF MINNESOTA,
OFFICE OF CHIEF FIRE WARDEN,
ST. PAUL, MAY 17, 1904.

Hon. S. G. Iverson, State Auditor and Forest Commissioner:

SIR: As required by section 3 of the Act for the Preservation of Forests, etc., approved April 18, 1895, amended by the Act of April 21, 1903, I have the honor to submit, herewith, my annual report for the year 1903.

Very respectfully,

C. C. ANDREWS,

Chief Fire Warden.

AUG 19 1904
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NINTH ANNUAL REPORT

OF THE

CHIEF FIRE WARDEN

OF MINNESOTA.

The standing timber in Minnesota is worth easily $100,000,000, and it is this property which the fire warden system seeks to protect. The state itself owns 2,500,000 acres of land, a part of which is forested and protected by the fire warden system. The state last November sold $600,000 worth of timber from its own land, and has in all received $4,000,000 for just the timber sold from exclusively its lands which it received as a gift from the United States. The state will continue for many years to sell timber of various kinds from these lands, and is on this particular account deeply interested in preventing damage by forest fires.

The local service in preventing and fighting fires, both forest and prairie, is rendered by the town supervisors, who are ex-officio fire wardens, and by those whom they summon to assist, and in unorganized territory by fire wardens specially appointed. This service is paid for in the first instance by the counties in which it is rendered, and the state pays to the counties two-thirds of such expense. Up to last year the state paid to the counties

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only one-third of such expense. It is expected that the counties now will be more prompt and liberal in paying such service. In an ordinary year it may be assumed that the two-thirds of expense the state has to reimburse to the counties will amount to $4,000. The other expenses pertain to the office of Chief Fire Warden, and include his salary, clerk hire, traveling expenses, postage, printing of warning notices, blanks, circulars, etc., and an edition of 4,000 copies of his annual report.

The item to cover all these expenses is found in the general appropriation act under the head of "Forest Preservation"; and I think the public will be surprised to learn that it amounts to only $5,000. It is an amount —I will not say wholly—but very inadequate for the efficient execution of the law. I recommend that the appropriation for each of the next two fiscal years for "Forest Preservation" be $10,000, and I trust that you will strongly indorse the recommendation. The amount which the legislature appropriates depends principally upon the Senate Committee on Finance and the House Committee on Appropriations. I have not failed to appear repeatedly before those committees to urge a larger appropriation.

Nobody knows when an exceptionally dangerous season may occur. It will not do to wait until it has come. Every spring the local fire wardens in about six hundred towns must be furnished with notices, instructions and blanks and kept on the alert so that in case a drouth should occur they will be active in preventing dangerous fires. The economical use of money is in the prevention of fires.

Our neighbor the province of Ontario expends $30,000 and upwards a year in the prevention and extinguishment of forest fires.

FOREST FIRES ELSEWHERE.

Before referring to the situation in this state in respect to fires, I would call to mind the excessive drouth, attended with very destructive forest fires, which prevailed in Oregon and Washington in the autumn of 1902, and the similar condition in the eastern states and Lower Canada in the spring and early summer of 1903. We are liable any year to experience a similar drouth, and should be prepared for it.

FOREST FIRES IN MINNESOTA, 1903.

Although wet weather prevailed during the latter part of the summer and in the season of harvesting, there were dry spells in the spring and late autumn. The number of forest fires reported by fire wardens was 52, which burned over an area of 15,585 acres and did damage to the amount of $28,292. At 27 of these fires, being a little more than half, a fire warden was present to assist in extinguishing and controlling the fire. Of these fires 11 were caused by clearing land, 9 by railroad locomotives, 7 from other known cause, and 25 originated from cause unknown.

The number of prairie fires reported was 35, which burned over 26,308 acres and did damage to the amount of $4,666. At 14 of these fires a fire warden was present, and assisted in extinguishing and controlling the same. They were caused, 9 from burning brush, straw or stubble, 4 by railroad locomotives, 3 by hunters, 6 from other known cause and 13 from cause unknown.

PROSECUTIONS.

There were 8 prosecutions for causing forest and prairie fires, and 4 convictions obtained. There is naturally great reluctance on the part of fire wardens to prosecute

their neighbors or fellow citizens for carelessness in causing fires, but how shall we abate the habit of negligence in the use of fire in dry weather unless it is made known that an offender will be held to account? If we leave the law a dead letter, what is going to prevent some terrible catastrophe in an extremely dry period? Are not humanity and kindness really on the side of a rigorous rather than a lax enforcement of the law? No man has a right to be setting fire either to brush or meadows in very dry weather. Any person of good conscience and common sense who sets fire to clear land or for other purpose will take such precautions by piling his brush, digging and carefully burning fire breaks as will prevent fire getting beyond his control.

The law as it now stands reads as follows: "Any fire warden who knows or has information of facts and circumstances which he believes can be established, and which if so proven would show beyond a reasonable doubt that any person has caused a fire in violation of this act, shall immediately go before a justice of the peace and make complaint thereof." The law requires that fire wardens shall, "without delay, inquire into the cause of each forest and prairie fire within their districts, and shall immediately report the same to the Chief Fire Warden." These officers have no discretion in the matter. The law is imperative, and they must, if they do their duty as respectable citizens and officers, prosecute people who carelessly cause forest or prairie fires, if evidence can be obtained.

It sometimes happens that witnesses will not swear in a trial of the case to just what they have previously stated. Convictions may not always be certain, but it does good in a community in such cases to have it understood that an honest and impartial effort will be made to have the law rigidly enforced. In this way we may prevent another Hinckley fire.

A view of Cass Lake from high ground. Much of the beautiful scenery in this locality has been mutilated by "dead and down" logging. Photographed, September, 1900, for the annual report of the Chief Fire Warden of Minnesota.

RAILROAD RIGHT OF WAYS.

Section 12 of the fire warden law requires railroad companies (which of course includes logging railroad companies) to keep their right of way to the width of 50 feet on each side of the center of the main track cleared of combustible materials. This is found to be a rather difficult provision to enforce. While some roads are kept cleared of combustible material in an exemplary manner, there are companies which are habitually neglectful in this regard. Railroad companies keep posted at their stations along their lines warning notices, furnished by the state, against forest and prairie fires, and which set forth, among other things, that any railroad company failing to keep its right of way cleared of combustible materials is liable to a fine not exceeding $100. What must the public riding over these roads think to read these notices, and then to see by the rubbish and combustible material left along the right of way that the company fails to live up to the law? On the other hand, where a company keeps its right of way thoroughly cleared of combustible material and in a trim condition, how valuable the example is, aside from the security against fires. It should not cost very much to do this work, and neglect of the railroad company faithfully to have it done does not indicate that scrupulous care which the public has a right to expect of corporations which are, above all others, supposed to exercise the strictest care that is possible.

With a view of having railroad companies observe more strictly this provision of law requiring their right of ways to be kept cleared of combustible materials a blank, like the one printed below, was furnished to the fire wardens whose towns are traversed by railroads. Pursuant to this 12 reports were received showing that the right of way was not clear of combustible material, and 24 reports

were received showing that the right of way was clear of combustible material; but the instructions do not require any report except in case the right of way is not cleared of combustible material. In cases where evidence of neglect was reported the facts were laid before the proper county attorneys, with request that prosecutions be instituted.

The enforcement of this provision of the law depends very much upon the assistance which is furnished by county attorneys.

STATE OF MINNESOTA.

Fire Warden's Report of Combustible Materials on Railroad Right of Way.

Section 12 of the Fire Warden Law (chapter 196, General Laws of Minn., 1895, as amended by the act approved April 21, 1903) requires every railroad company to keep its right of way to the width of fifty feet on each side of the main track cleared of all combustible materials. This requirement is set forth in the notices freshly posted each year at every railway station, and its disregard is likely to be noticed by the public to the discredit of the fire warden service, let alone the pecuniary damage that might result. Fire wardens are hereby instructed to promptly report any violation of this provision. They will be held strictly responsible for its enforcement. Especially will the chairman inspect in a dry season, and before dangerous weather, any railroad right of way in his town where there is adjoining property over which fire would be likely to spread and do damage if started on the right of way, and if combustible material, whether dry grass, weeds, bushes or other kind, is found on the right of way, to immediately report the facts to the Chief Fire Warden in the form below. In such case there should be an additional respectable witness of the combustible materials. The fire warden who discovers the presence of combustible materials in a case as above stated will promptly warn the section foreman or other proper railroad employe or officer to remove the same, and will observe and report to the Chief Fire Warden whether, and when, such material is removed. Respectfully,

C. C. ANDREWS,
Chief Fire Warden.

ST. PAUL, May 7, 1903.

To the Chief Fire Warden, St. Paul, Minn.:

On the ....day of.....190.... the undersigned personally inspected the right-of-way of the (state name of railroad company)..... ..... railroad, in the town of.....being Township No.... Range....,in the County of.....for the distance of (state about the number of miles or rods inspected) about..... .....and between.....and..... (indicate locality as nearly as practicable). Combustible materials consisting of (state whether dry grass, weeds, bushes or what kind, and how high and abundant, and whether standing, cut or in heaps).....

were found (state whether on one, and which, or both sides of the right-of-way and what breadth of the right-of-way from center of the track).....
Such combustible material extended along the right-of-way a distance of about (state number of rods or miles).....
and between (indicate by village, stream, farm or other object)
..... and .....
Adjoining the right-of-way where such combustible material was found there was on (state which side) the.....side (state whether timber, bushes, stubble, grain in shock or stack, hay in shock or stack, or what property and whose, if you know, that could be damaged or endangered by the spread of fire, and about to what extent. If there was property on both sides of the right-of-way that could be endangered by fire spreading from combustible material on the right-of-way, so state and describe the same. Be particular and follow these instructions carefully).....
.....
.....
.....
The weather was.....
Name and address of the witness who accompanied the undersigned is.....
P. O..... Signature.....
Date..... Named of Organized Township.....

SUMMARY OF FOREST FIRES, 1903.

County and Town.	Date.	Acres.	Damage.	Cause.
Aitkin County—				
Millward	June 5	40	$75	Unknown.
Anoka County—				
Bethel	May 8	320	12	Burning hay.
Beltrami County—				
Black Duck	May 7	3	None	Clearing land.
Black Duck	May 17	3	None	Children playing.
Black Duck	July 22	20	500	Railroad locomotive.
Black Duck	July 27	120	1,800	Unknown.
Frohn	May 19	500	200	Clearing land.
Grant Valley	April 17	70	300	Railroad locomotive.
Grant Valley	April 22	100	500	Railroad locomotive.
Grant Valley	May 7	30	250	Railroad locomotive.
Hagalie	July 15	20	100	Unknown.
Hornet	June 4	25	10	Clearing land.
Lammers	July 29	640	200	Railroad locomotive.

SUMMARY OF FOREST FIRES, 1903—*Continued.*

County and Town.	Date.	Acres.	Damage.	Cause.
Carlton County—				
Knife Falls	June 4	160	None	Clearing land.
Knife Falls	June 28	40	None	Unknown.
Cass County—				
Twp. 146, R. 31	July 28	320	150	Unknown.
Twp. 145, R. 30	Nov. 4	10	50	Railroad locomotive.
Clearwater County—				
Leon	June 22	160	35	Unknown.
Moose Creek	May 16	160	30	Unknown.
Moose Creek	May 23	80	10	Burning meadow.
Shevlin		120	None	Burning brush.
Cook County—				
Hovland	June 7	640	1,000	Unknown.
Maple Hill	June 1	200	None	Clearing land.
Maple Hill	August 23	5	10	Land cruisers.
Maple Hill	August 30	1	5	Land cruisers.
Tofte (58-5)	June 7	160	1,800	Burning rubbish.
Tofte (60-3)	June 7	2,000	10,000	Clearing land.
Itasca County—				
Campbell	June 3	600	800	Clearing land.
Moose Park	June 7	½	None	Unknown.
Nashwauk	April 27	300	2,000	Unknown.
Nashwauk	June 1	350	1,000	Unknown.
Nashwauk	June 7	280	2,000	Unknown.
Third River	May 15	160	50	Clearing land.
Kittson County				
Arveson	May 7	1,500	300	Unknown.
Deerwood	April 17	160	50	Unknown.
Lake County—				
Two Harbors	May 31	100	None	Railroad locomotive.
Morrison County—				
Buckman	Nov. 20	2,000	400	Unknown.
Clough	Nov. 18	600	80	Clearing land.
Roseau County—				
Herim	Oct. 19	1,500	200	Unknown.
St. Louis County—				
Canosia	June 29	30	25	Railroad locomotive.
Duluth	June 7	20	Slight	Unknown.
Herman	June 28	2	20	Railroad locomotive.
Lakewood	June 7	40	50	Unknown.
Midway	April 27	60	20	Campers.
Missabe Mountain	June 7	160	1,000	Unknown.
Missabe Mountain	June 21	160	500	Unknown.
Sparta	June 7	200	2,000	Unknown.
Twp. 54, R. 21	June 7	1,200	600	Unknown.
Twp. 55, R. 18	June 26	100	60	Unknown.
Twp. 61, R. 14	June 30	7	50	Unknown.
Todd County—				
Browerville	May 2	1,000	Brush	Unknown.
Burnhamville	April 27	100	50	Clearing land.

Total acres burned over, 15,585. Damage, $28,292.
Classification of causes:
Clearing land, 11.
Railroad locomotives, 9.
Other causes, 7.
Unknown, 25.

Report of Fire Wardens and Others of Forest Fires for 1903.

AITKIN COUNTY.

Ernest Rainins, chairman, town of Millward, June 24:

On the 3d instant, about 3 o'clock, p. m., a fire started on section 5, which burned over 40 acres and destroyed nearly 15 acres of fine, green, old birch and balsam; damage $75. I was working on section 6 and saw heavy, black smoke beginning to rise from section 5; I immediately went to the fire, which was burning briskly on land cut over last winter. It was extinguished by watching and holding it. Eight persons assisted. I notified the chairman of the town of Beaver to be ready if more men should be needed. The weather was dry and windy, and had been dry for about two weeks. I believe someone walking over the land started the fire with no reason for so doing.

ANOKA COUNTY.

W. S. Fenderson, chairman, town of Bethel, May 8.

A fire today, caused by someone burning hay land on section 13, burned over half a section of meadow and light timber; damage $12. It came near burning a house, barn and outbuildings; was extinguished in 6 hours by two men digging a trench. Weather dry and windy for five days. The fire did not burn deep enough to kill the timber.

D. D. Rolfe, president, village of Black Duck, September 23:

May 7th a fire on section 12, caused by clearing land and burning brush, burned over about 3 acres of light timber; damage nominal. It was extinguished by using the street engine and hose. Weather dry and windy; had been dry all spring.

Same, September 23:

A fire May 17th burned over about 3 acres of partly cleared land on section 12; damage nominal. Origin unknown, probably by children playing. Fire was extinguished in 6 hours, thirty-one persons assisting, by using the street engine, hose and buckets. Weather dry and windy; had been dry all spring.

Same, September 23:

On the 22nd and 23rd of July a fire started at 1 o'clock on section 18 and burned over about 20 acres of heavy cedar timber; damage $500. The fire is supposed to have been started by the train. It was extinguished in 28 hours by twenty-two persons, using the street engine, hose and buckets and chopping down trees. Weather dry.

Same, September 23:

On the 27th of July a fire on section 13 burned over about 120 acres of heavy cedar timber and destroyed poles and posts; damage $1,800. It was caused, as near as we can find out, from a chimney in one of the cedar camps or from a freight train. Weather dry with high wind. It was extinguished in 7 hours by two hundred persons assisting, and by using the hose and mains, street engine and bucket brigade.

J. W. Speelman, chairman, town of Turtle Lake, September 8:

The summer was very dry until August 1st.

Nelson Willett, chairman, town of Frohn, May 12:

On the 9th instant at 10 o'clock a fire originating on section 28 burned over 500 acres of heavy timber and destroyed some camps and small timber; damage $200; caused by clearing land. It was extinguished in 12 hours by the use of shovels on road ways. Weather dry and windy; had been dry for a week.

A. P. Reeve, fire warden, town of Hagalie, July 16:

Yesterday noon a fire on section 35 burned over about 20 acres of cedar slashings and destroyed a small amount of cedar poles and posts; damage $100. The fire was extinguished in 3 hours by the help of twenty-five or thirty persons by back-firing and carrying water. Weather very dry, light windy gusts. The fire would have been very serious if not checked at the start. I saw the smoke and was there when it had about a quarter of an acre burned over, and being on horseback I made quick time in getting men out. The fire started near the corner of section 36 and endangered $3,000 worth of timber.

Gust Dohrman, chairman, town of Grant Valley, May 9:

Fires April 17th and 27th caused by sparks from a Great Northern locomotive did damage estimated at from $75 to $100. The weather was very dry. The fires were extinguished by the use of shovels and water carried in buckets.

Henry Plumer, chairman, town of Hornet, May 8:

June 4th a fire caused by clearing land on section 25 burned over 10 acres of light cedar and destroyed a very few logs and killed a few trees; damage $25. It was extinguished in 24 hours by the help of five persons, putting water on the dry road ahead of the fire. Weather

dry for two weeks. There is much slashing in our town this spring. Should present dry weather continue there will soon be danger of fire here.

Same, June 26:

On the 14th we had a small fire which was soon put out. It was started at the pulp camps.

Andrew Larson, chairman, town of Lammers, August 3:

July 29th, in the afternoon, a fire on sections 18 and 19 burned over 600 acres of brush and destroyed about 20 tons of hay—clover and timothy; damage $200. There was also a fire on sections 7 and 8; came from the adjoining township on the west, but did no damage. It has been impossible to extinguish it; but now we have some rain, so I think it is dead now. Weather has been dry the whole summer. I might say this country has never been so dry. I have been out three days around those fires and we thought we had them all out, but when we got a warm day they started up again. The first mentioned fire was supposed to have been started by a railroad locomotive.

CARLTON COUNTY.

John Blomberg, chairman, town of Knife Falls, October 30:

On the 4th of June a fire on section 1 burned over 160 acres of brush and light timber. It was thought that the fire was started by the wind from a clearing belonging to a settler living in the same section, who was clearing land and burning brush at the time. It was extinguished in 12 hours by the help of eight persons carrying water, digging ditches and covering fire with the dirt; also felling trees. Weather dry and windy; had been dry about 4 weeks.

were badly scorched and burnt. Had the wind been from the north I am afraid it would have been quite a difficult matter to have saved much of the Norways. I made diligent inquiries among the whites who had been camping on the island up to that time, but none of them appeared to acknowledge camping in the vicinity where the fire started, nor do I believe they did, because the location would not be desirable. Indians were picking a great many berries in that locality and I feel quite certain it resulted through some carelessness on their part.

Same, November 4: (Telegram)

Bad forest fire raging in white pine near Cuba, five miles east. Will leave with force of men about 10:30 per train furnished gratis. If necessary will increase force in morning. Weather conditions favorable.

Same, November 5: (Telegram)

Fire subdued. Will leave couple of patrols in charge.

Same, November 6:

The fire was near what is called Cuba siding; burnt on south side of track over an area of about 10 acres. Considerable slashings and dry stubs in the vicinity, where some years ago dead and down logging was done to some extent. Fire destroyed the seedlings, but neither Mr. Bruce (of the Forestry Bureau) nor myself could find where it destroyed the hardy white pine. Weather conditions were fine; had there been a wind it would have taken quite a force and much time to check it. Fire may have originated from railroad engine sparks; also from travelers or tramps, who just now continually build camp fires en route. Two such "hobo" fires were burning between here and the scene of the forest fire on the night we went there.

CLEARWATER COUNTY.

Alfred Forander, chairman, town of Moose Creek, May 23:

About noon the 16th instant a fire on section 34 burned over 160 acres of heavy and light timber; destroyed 5 or 6 cords of wood.

Same, June 5;

May 23d a fire on section 35 burned over 80 acres and destroyed about 500 poplars of pole size. There is a big slough one mile across and four miles long and the fire came in on us from that slough. It was extinguished in three hours by back-firing. The wind was high.

F. A. Norquist, chairman, town of Pine Lake, August 10:

It is very dry here this summer.

Same, August 24:

The weather has been quite dry until to-day, it is raining hard.

O. J. Larson, chairman, town of Shevlin, July 30:

A fire on section 13 (township 147, range 36), July 15, burned over 120 acres of brush land; no damage. It was caused by burning brush piles. As the weather was very dry and windy part of the time it could not be put out, but was kept under control until it rained. Weather dry for about a month and windy part of the time.

COOK COUNTY.

Ole E. Erickson, chairman, town of Hovland, June 29:

June 7th a fire, cause unknown, burned over 640 acres of principally green timber on sections 11 and 12; damage $1,000. It was extinguished June 16th by the help of six persons, five being part of a lumber crew. It was kept back in the daytime as best we could, but at night and early morning we could do the most active work. There was a good deal of dry, fallen cedar. There had been about two weeks or more of dry weather before the fire

and it was dry and windy at the time, but we got a rain storm on the night of the 16th.

August Johnson, chairman, town of Maple Hill, June 15:

June 1st a fire on section 2 burned over 100 acres of brush land, but destroyed nothing of real value. It was extinguished thirteen days after it started, by the help of forty-seven persons, with water and shoveling dirt on the fire.

Same, August 27:

On Sunday, the 23d we discovered fire in section 11-62-1 E., near Elbow Lake, and I sent at once an assistant to extinguish the same. Five acres of green timber was undermined by fire so that the trees fell to the ground, but to-day the fire is out, and I have two watchmen to watch it for further spread. Weather very dry and windy. Also report from 64-1 E., section 2, where there is also fire. It is very difficult to get there on account of road and waterways. It is about thirty miles from here, but I will do my best to attend to it. This fire has been set by cruisers, and the guilty party I may be able to locate, and I will report to you.

Same, September 9:

August 30th a fire caused by land cruisers on section 11, town 64, range 1 E., burned over an acre of light timber and destroyed a few trees. It was extinguished in three days after it started. Weather very dry and windy.

H. O. Engelson, fire warden, town of Tofte, June 13:

June 7th a fire on section 6, town 58, range 5, burned over 160 acres of light timber and buildings; damage $1,800. It was caused by the burning of a small pile of rubbish in front of men's sleeping camp of a lumber company. Weather extremely dry and windy, had been dry for more than a week. Fire was extinguished by carrying water from Lake Superior and by the rain which came in the evening.

C. A. A. Nelson, fire warden, town of Tofte, June 17:

On the 7th instant a fire on section 27, town 60, range 3, caused by burning brush, spread over 2,000 acres of light timber land and destroyed a logging camp with implements and two homestead houses; did damage to the amount of $6,000, including $4,000 worth of buildings. It was extinguished in nine days, eleven persons assisting, by digging up dirt, cutting down timber and carrying water. The weather was dry and windy, had been dry for two or three weeks.

ITASCA COUNTY.

James Troy, chairman, town of Bridgie, October 30:

There has been no fire in this town, but in the town adjoining on the west (151-30) ties were made last winter in section 36, through which the railroad runs, and the slashing is all over the whole section, which would cause great damage to the state timber if it caught fire. It should be looked into, as fire could easily start and run east into the settlement of Bridgie, and great damage be done.

H. C. Grove, chairman, town of Campbell, June 11:

On the 4th instant a fire caused by burning brush on section 25, town 155, range 25, burned over about 600 acres of brush, jack pine and some Norway, mostly small timber and some down timber; damage $800. Weather dry and had been dry for some time, with hardly any wind. It was extinguished in four days after it started, with the help of about twenty persons, using axes and shovels and cutting down timber and digging trenches; some places a team and plow were used. The fire was fought more or less all the time until it was put out by rain. This is the only organized town for miles around. Parts of the country are sandy and covered with jack pine and in dry weather very dangerous in case of fire. There

is no wagon road in here; the mail is packed here from Mizpah to Ripple (P. O.) It is in town 154, range 25. Big Falls is in section 2, town 154, range 25; Ripple, the post office, is in the same section. The road from here to Black Duck is swampy and can only be traveled afoot.

Henry Cole, chairman, town of Moose Park, June 9:

On the 7th instant, about noon, a fire on section 17 burned over half an acre of brush and slashings; no damage done. It was extinguished with the help of seven persons by carrying water in pails, there being a creek close by. It was almost impossible to put the fire out, as it hung to the roots and moss. Weather dry and windy, has been dry all spring, with no rain to amount to anything.

S. R. Elliott, Sup't Crosby Mine, Nashwauk, April 29:

April 27th a fire came from the south of our property, which is situated in sections 31 and 32, town 57, range 22, and destroyed much cord wood belonging to us.

Same, May 13:

The fire of April 27th burned only about 75 cords of wood which we had cut. It would have burned all of our buildings if we had not fought it with our whole force of about 100 men. Two dwelling houses were destroyed and much cord wood belonging to other parties.

C. E. Walton, chairman, town of Nashwauk, May 11:

I have inquired into this fire you have mentioned, but it is almost impossible to find out anything about it, for there are so many tramps and lawless gangs around here camping through the woods. This fire started south of us, near the railroad track, but cannot find out any more about it.

Same, June 1:

A fire on this date burned over part of sections 31 and 32; destroyed an ice house; also from 300 to 400 cords

of wood. It is still burning; damage $1,000. It is impossible to find out how it was caused. Thirty-three persons assisted in controlling the fire with buckets and hose from the mines. Had to let it run as far as the mine before we could stop it. Weather dry and windy; dry about two weeks.

Same, June 9:

On Sunday, the 7th instant, a fire burned over 140 acres in section 31, 140 acres in section 32 and 340 acres in section 29, of both heavy and light timber, and destroyed two of our houses at the lower mine; damage to mining property $2,000. Number persons assisting in controlling the fire was from 200 to 300. It was finally extinguished by rain. Weather dry and very windy.

F. S. Arnold, chairman, town of Third River, July 11:

On or about May 15th a forest fire ran through the southwest quarter of the southeast quarter of section 24. So far as I can ascertain no great damage was done, but I am unable to state how the fire originated.

KITTSON COUNTY.

Frank Peterson, chairman, town of Arveson, May 11:

On the 7th instant a fire burned over 1,500 acres of brush and prairie and some poplar groves. Twelve persons assisted in putting the fire out with help of team and breaking plow; also by using wet sacks. Weather dry, with west wind.

B. M. Bathum, chairman, town of Deerwood, April 22:

April 17th at 9 A. M., a fire on section 3 burned over 160 acres of light timber and brush. Have investigated but am unable to find out who set the fire. Neighbors claim it was set by a party driving on the road. It was put out in five hours by the help of eight persons.

LAKE COUNTY.

L. St. Jaques, chairman, town of Two Harbors, June 22:

May 31st a fire on section 15, town 53, range 11, burned over 100 acres of cut-over timber and was caused by sparks from an engine. No damage. It was extinguished in one day with the help of six persons by back-firing. Weather dry.

MORRISON COUNTY.

Samuel Tedford, chairman, town of Clough, December 1:

On the 18th of November a fire, caused by burning brush on section 5, burned over 600 acres; destroyed 10 tons of hay. Damage $80. It was extinguished by the help of eight persons by water and other means. Weather windy and dry.

J. O. Baker, chairman, town of Morrill, November 23:

On the 20th instant a fire on section 36 burned over an area of five miles in length by 4 rods to 1½ miles in width of meadow and light timber; destroyed about 50 tons of hay. Damage $400. I cannot find the party who set the fire; nobody seemed to know anything about it. The fire was extinguished in twelve hours by individuals—about fifteen fighting it for the protection of their own property. Weather dry for seven or eight weeks, very high wind.

ROSEAU COUNTY.

Thomas Larson, chairman, town of Deer, November 4:

On the 19th of October in the afternoon, a fire burned over 1,500 acres of brush, meadow and light timber; destroyed about 75 tons of hay. Damage $200. It burned to a big slough, when it stopped. It came from the town of Herim. The weather had been dry about a week and the wind blew hard from the northwest, which

brought the fire into our town, where all the hay was destroyed. We have spent three days trying to find out who set the fire, but are unable to find out.

ST. LOUIS COUNTY.

Edward Olson, president, village of McKinley, in township of Biwabik, June 27:

We are in no danger at present from forest fires. The fire the first part of this month caught in slashings from the Elba Iron Company and burned over about 80 acres of ground, but no valuable timber was destroyed.

Olof Shirley, fire warden, town of Canosia, June 29:

If this dry weather keeps on we shall have some bad forest fires on account of the M. & W. R. R. locomotives. They are setting fire every day at certain places where the sparks fall in combustible material. I do not think they have the right kind of spark arresters on.

Henry Kirke, chairman, town of Duluth, June 15:

On the 7th instant a fire on section 34, about seven miles from where I live, burned over from 15 to 20 acres old choppings; destroyed some cedar ties—there was no valuable timber; very high wind all day. Weather had been dry ten or twelve days. The fire was finally put out by rain.

C. G. Almquist, chairman, town of Herman, June 2:

There have been some small fires along the line of the logging railroad from Scanlon, doing small damage; but if dry weather starts in there might be danger of some big fires caused from it.

Same, July 1:

June 28th at 4 P. M., a fire on section 20, probably caused by the logging train, burned over two acres of light timber; destroyed five cords of wood and some pine. Extinguished by shoveling earth over it. Weather dry but no wind.

David Jamieson, chairman, town of Lakewood, October 27:

June 7th a fire on section 18 burned over 40 acres of light timber; destroyed a small quantity of hardwood. Damage possibly $50. Was extinguished in 12 hours after it started by heavy rain. The weather had been dry for about two weeks before the fire and was windy the day of the fire.

H. B. Hill, chairman, town of Midway, October 23:

April 27th a fire on section 29 burned over 60 acres of brush land; was probably set by hunters or campers. It was extinguished in five hours with the help of fifteen persons by water.

A. J. Sullivan, chairman, town of Mesaba Mountain, June 12:

On Sunday, the 7th instant, a fire on section 35, on the south shore of Lost Lake, burned over 160 acres of brush and old slashings; damage $1,000. A strong wind was blowing from the northwest and the fire burned fiercely through the old slashings, including some timber and cordwood, until it reached the green timber on the south, where it died. The fire lasted about six hours. A number of men and the owner went to fight the fire but could make no noticeable impression. The weather was not dry. It rained heavily about six days previous. Wind very high.

Same, June 27, Telegram:

Fire north of Genoa confined to slashings. Very little loss to pine. I have had men looking after it all week. Impossible to stamp it out, as weather is very dry, with high winds prevailing. Will write report.

Same, June 30:

On the 21st instant about 1 p. m., a fire originating on section 27—cause unknown—perhaps from wad of a hunter's gun—burned over 160 acres of slashings; de-

stroyed very little standing timber. Damage perhaps $500. Weather very dry, with high wind prevailing. Four men watched the fire and it was finally extinguished in a week by heavy rains.

D. E. Mouser, Sparta, June 26, Telegram:

Forest fire burning fiercely north of Genoa. Place you inspected. Spread to the large pine.

Same, June 27, Telegram:

Fire mostly out; unless wind rises will be all right.

John Hillman, Floodwood, June 15:

On the 7th instant a fire originating on section 7, town 54, range 21, burned over 1,200 acres of cut-over land; destroyed 200,000 feet of pine. Damage $600 Four persons assisted in controlling the fire. Rain started and extinguished it.

Chas. Lauren, fire warden, Zim, June 29:

June 26th a fire in the northwest part of town 55, range 18, burned over 100 acres of brush, slashings and light timber; destroyed 6,000 feet of pine and a few cedars. Damage $60. Weather dry and windy; had been dry for about three weeks. The fire was running along both sides of the logging railroad where timber had been cut last winter. It was controlled by making fire breaks and was finally extinguished by rain.

Chas. Heise, Tower, October 10:

The last Sunday in June we had a fire in section 4, town 61, range 14, and when I saw the smoke I got help from one of the camps and we worked about four hours and had it all out. There were about seven acres burned over. We had no large fires during the season, which was prevented by my putting out small fires.

Southeastern part of Lake Superior Forest Reserve, looking north from high bank of river leading from Wigwam Lake. Photographed July 15, 1903, for the annual report of the Chief Fire Warden of Minnesota.

TODD COUNTY.

Hans Hammer, chairman, town of Little Elk, May 19:

May 2nd a fire in the southwest part of the town burned over 1,000 acres of brush but did no damage. The weather had been dry for some time and windy. A heavy rain extinguished the fire, since which time there has been plenty rain.

Frank Krutzer, chairman, town of Burnhamville, May 18:

On the 27th of April a fire on section 28, caused by clearing land, burned over 100 acres of light timber; damage $50. It was extinguished by plowing and with water. Weather dry and windy.

SUMMARY OF PRAIRIE FIRES, 1903.

County and Town.	Date.	Acres.	Damage.	Cause.
Anoka County—				
Linwood	May 13	15	Slight	Burning meadow
Clay County—				
Barnesville	April 26	1,200	$25	Unknown.
Elkton	Oct. 31	500	210	Burning stubble.
Hawley	Oct. 31	50	200	Unknown.
Riverton	April 27	3,000	50	Unknown.
Riverton	Oct. 31	1,500	1,500	Burning stubble.
Ulen	Oct. 21	60	50	Burning stubble.
Kittson County—				
Clow	Oct. 19	2,000	500	Boys.
Deerwood	April 17	1,600	.....	Unknown.
Hazelton	Sept. 30	300	91	Hunters.
Hazelton	Nov. 1	60	None	Unknown.
Jupiter	Nov. 14	320	None	Unknown.
Norway	May 15	500	100	Burning brush.
Pelan	Oct. 31	500	75	Burning stubble.
Percy	Oct. 25	1,200	None	Unknown.
Richardville	April 21	40	None	Unknown.
St. Joseph	Oct. 10	800	200	Burning break.
Teien	July 28	120	125	Smoker.
Marshall County—				
Agder	Oct. —	1,000	None	Hunters.
Augsburg	Nov. 10	620	50	Burning fire break.
Foldal	Oct. 10	200	25	Burning straw.
Grandplain	Oct. 22	500	None	Hunters.
Morrison County—				
Ripley	April 15	40	None	Small boy.

SUMMARY OF PRAIRIE FIRES, 1903—*Continued.*

County and Town.	Date.	Acres.	Damage.	Cause.
Otter Tail County—				
Carlisle	Nov. 3	3	None	Railroad locomotive.
Polk County—				
Argus	Oct. 15	1,000	70	Railroad locomotive.
Onstad	Sept. 24	800	500	Railroad locomotive.
Red Lake County—				
North	May 20	400	None	Clearing land.
Terrebonne	July 15	160	240	Unknown.
Roseau County—				
Dewey	Oct. 28	400	100	Clearing land.
Polonia	Mch. 9	40	50	Clearing land.
Polonia	Oct. 10	1,200	200	Unknown.
Polonia	Oct. 29	400	80	Unknown.
Wilkin County—				
Manston	April 4	6,000	200	Unknown.
Mitchell	April 4	200	None	Unknown.
Prairie View	Sept. 24	80	25	Railroad locomotive.

Total acres burned over, 26,308. Damage, $4,666.

Classification of causes:

Burning brush, straw or stubble, 9.
Railroad locomotives, 4.
Hunters, 3.
Other causes, 7.
Unknown, 13.

Report of Fire Wardens and Others of Prairie Fires for 1903.

ANOKA COUNTY.

J. R. Broadbent, chairman, town of Linwood, May 14:

Yesterday a fire on section 32 burned over 15 acres of meadow and would have destroyed a bridge had it not been extinguished. As it was, no damage was done.

CLAY COUNTY.

R. Sieber, chairman, town of Barnesville, May 4:

April 26th a fire in the south part of the town burned over 1,200 acres and destroyed hay of the value of $25. It went across the creek to section 23. I could not find out how it was set. There was a strong wind.

Leander Swartz, chairman, town of Elkton, November 3:

On the 31st of October a fire caused by burning stubble, the weather being dry, burned over several hundred acres in the north part of the town and destroyed about 70 tons of hay; damage $210. Many persons helped extinguish the fire by plowing and whipping with wet sacks. The party who caused the fire was tried and fined $45 and costs.

W. Fountain, chairman, town of Hawley, November 2:

October 31st about 4 o'clock P. M., a fire burned over 40 or 50 acres of wild meadow and destroyed 40 tons of hay; damage $200. It was extinguished in about four hours by plowing and back-firing. A whole threshing crew and others volunteered. The weather was dry and had been dry about two weeks; but little wind. The fire originated, it is supposed, near Downer, Minnesota, six or eight miles southwest of where it touched our town. It just touched one corner of the township.

Same, November 16:

I find that the fire which I reported the 2d instant was caused by a party who set fire to burn off the land when he had made a fire break of only six furrows. He was fined $45 and cost.

Edward Weaver, chairman, town of Riverton, April 27:

On the 26th instant a fire which originated on section 36 burned over seven sections and destroyed two stacks of hay of the value of $50. It was extinguished in twelve

hours with plows, sacks and brooms. Weather had been dry for a week.

Same, November 2:

October 31st a fire burned over 1,500 acres of prairie and destroyed twenty-eight hay stacks; damage $1,500. It was controlled by twenty-five persons, using six plows and wet sacks and by back-firing. Weather dry with high wind. (Same fire reported by L. Swartz.)

E. Rost, chairman, town of Ulen, October 25:

On the 21st instant a fire caused by a boy 15 years old, plowing and who started a fire to burn off the dead grass and weeds, burned over 60 acres and destroyed two hay stacks of the value of $40 to $50. Sixteen persons assisted in extinguishing the fire.

KITTSON COUNTY.

Richard Sylvester, chairman, town of Clow, October 21:

On the 19th instant a fire supposed to have been set by two boys 12 and 14 years old, burned over 2,000 acres of prairie and meadow and destroyed 150 tons of hay; damage $500. The fire ran as far as the prairie went. Weather dry and windy for about four weeks.

John Stramquist, chairman, town of Deerwood, April 25:

On the 7th instant a fire originating on section 24 burned over 1,600 acres of brush and prairie. Weather dry and windy. It was extinguished by ten persons putting it out along roads and fields.

Isaac Ristad, Fire Warden, town of Hazelton, October 19:

On the 30th of September a fire burned over two-thirds of section 27 and destroyed about eight tons of hay and thirty acres of green timber; damage $91. All that I can learn is that there were three chicken hunters who set the fire, but I cannot find any way to identify them. Thirty-five persons assisted in putting out the fire. It was

extinguished in nine hours after it started, with sacks, brush and two teams and plows. It was dry and very windy all that day, but it had been damp weather about a week before.

Ole Krogstad, chairman, town of Hazelton, November 10:

On the 1st instant at 3 P. M., a fire burned over 60 acres of prairie on section 16. After thorough investigation the cause cannot be discovered. Three persons assisted in putting it out, using brooms made of willows.

Louis Swanson, chairman, town of Jupiter, November 17:

On the 14th instant a fire burned over 320 acres on section 23. Seventeen persons assisted in putting it out. The weather was dry and calm.

N. G. Bengtson, town clerk, town of Jupiter, December 9:

As to the fire reported by Mr. Swanson of November 14th, it was very hard to say what damage it might have done if it had not been extinguished; one thing is sure, had the wind started up and blew hard lots of hay stacks would have been burned and probably some houses. As it was, very little damage was done. It burned only some old grass. The land belongs to speculators and there is no cultivation done on that section.

Isak T. Tolland, chairman, town of Norway, May 18:

May 15th, a fire caused by burning brush and roots on section 2, town of Deerwood, burned over 500 acres of brush and swamp on section 35 of this town; damage $100. It was extinguished with the help of nine men. Weather dry and windy for about five days.

C. E. Kelso, chairman, town of Pelan, December 10:

On the 31st of October a fire originating on section 22 burned over 500 acres of prairie and brush and destroyed one homestead shanty and about twelve tons of hay; damage $75. The fire could not be controlled in this

town and went into another town. Weather dry and windy, had been dry for about three weeks.

Same, January 2, 1904:

The party accused of setting the fire of October 31st has been tried and acquitted.

B. Nelson, chairman, town of Percy, October 30:

On the 25th of October a fire which came from the north, town 162, range 46, into this town on section 5, where the land is unsettled, spread over sections 8, 9 and 10. It was extinguished in the evening by the work of nine persons by back-firing and using wet sacks, thus saving 140 tons of hay. If the fire had not been checked in time it would have done damage to hay and buildings. There was wind from the northwest and it has been dry for four weeks. The fire burned over about 1,200 acres of meadow and brush land. There has been fire in North town over two weeks.

Geo. Richards, chairman, town of Richardville, May 1:

April 21st a fire burned over a few sections of prairie in the northwest part of the town; no damage done here. The weather was quite windy. I cannot find out who started the fire nor exactly where it started from. I was not at home, being away to a funeral that afternoon.

John Zalewski, chairman, town of St. Joseph, October 10:

At 9 o'clock today a fire originating on section 8 burned over 800 acres of meadow and brush and destroyed 50 tons of hay and some poplars; damage $200. South wind and dry for one week. The fire went to Manitoba. It is believed to have been caused by a person burning a fire break around a haystack.

Louis E. Johnson, chairman, town of Teien, August 15:

July 28 a fire on section 36, caused by a farmer from Dakota cutting hay, burned over 120 acres of prairie and meadow and destroyed 30 tons of hay in stack and 40

tons standing; damage $125. It was extinguished in three hours with the help of fifteen or twenty persons by plowing and by using wet sacks. Weather windy and dry; had been dry for a long time.

MARSHALL COUNTY.

Bernhard Knudsen, chairman, town of Agder, November 2:

In October a prairie fire burned over about 1,000 acres of swamp but destroyed nothing of value. The weather was dry and windy the whole of last month.

Chas. Warner, chairman, town of Augsburg, November 14:

On the 10th of August a fire caused by two boys trying to burn around their haystack in section 1 burned over 620 acres and destroyed three stacks of hay; damage $50. It was extinguished in eight hours by ten persons with plows and wet sacks. Weather quite windy.

Amund Johnson, chairman, town of Foldal, October 15:

On the 10th instant about 10 o'clock a. m., a fire supposed to have started from an old burning strawstack spread over 200 acres of brush and prairie and destroyed one haystack; damage $25. The weather was dry, with strong wind.

Henry Roller, chairman, town of Grand Plain, October 21:

October 18th a fire set by hunters burned over 500 acres of prairie and swamp in township 156, range 42. It was extinguished in two days by twelve persons by plowing, back firing and beating with wet sacks. A dwelling house was saved and 150 tons of hay. Weather very dry and windy and had been dry most of the time.

MORRISON COUNTY.

J. A. Adams, chairman, town of Ripley, May 2:

April 15th a field fire burned over 40 acres and died out. Supposed to have been set by a small boy; no damage. There had been a heavy rain three days before the fire occurred. The fire by which an old lady lost her life was half a mile distant from this fire and was set by herself. It destroyed no property and was not a prairie fire.

OTTER TAIL COUNTY.

William Zimmer, chairman, town of Carlisle, November 4:

On the 3rd instant a fire caused by sparks from a railroad locomotive burned over 3 acres but did no damage. It was extinguished by one person with wet sacks and shovel. Weather dry and windy for about 2 weeks.

POLK COUNTY.

S. M. Clover, chairman, town of Angus, October 26:

On the 15th instant a fire, thought to have caught from sparks from a locomotive on the G. N. R. R., burned over 1,000 acres; destroyed about 70 tons of hay and 1 barn worth $70. It was extinguished in 10 hours by eight persons by plowing in front of it with a 4-horse gang plow and a 3-horse breaking plow, confining it within certain limits. Weather dry and very windy.

Sever Quarberg, chairman, town of Onstad, September 29:

September 24th about 10 o'clock a. m., a fire caused by an N. P. locomotive burned over 800 acres and destroyed about 125 tons of wild hay of the value of $500. It was extinguished in 4 hours by twelve persons and six teams plowing furrows and dousing with wet sacks. Weather dry and windy; had been dry for about 8 days.

RED LAKE COUNTY.

Mrs. E. Avetson, St. Hilaire, May 1:

A prairie fire has been set and has burnt all the hay I had.

John S. Smith, chairman, town of North, October 28:

May 20th a fire supposed to have been set by a farmer clearing hay land burned over 400 acres but did no damage. The weather was dry and windy; had been dry for about three weeks before.

Louis Parenteau, chairman, town of Terre Bonne, November 12:

July 15th a fire burned over 160 acres of hay land and destroyed about 35 tons of hay already cut; damage $240. Cause unknown. Four persons assisted in putting the fire out. Having no water, had to plow around it and use brush brooms. Weather dry and had been dry for a couple of months.

ROSEAU COUNTY.

Julius Johnson, chairman, town of Dewey, November 2:

On the 28th of October a fire caused by clearing land burned over about 400 acres of prairie and destroyed 18 tons of hay; damage $100. It went out after reaching a wet slough. The weather was dry and windy, had been dry for about three weeks.

Henry Brufladt, Siggstad, October 16:

A prairie fire was started about eight miles south of here across the Roseau swamp on the 10th of October, the wind being the hardest we had this summer, and struck my grove and jumped the fire break and came near destroying all my property. I saved all except my hay—50 loads of number one hay destroyed—leaving me with hardly any for the winter for ten head of cattle and

five horses. It is noticed that a fire is started in the same neighborhood nearly every fall.

Joseph Kansy, chairman, town of Polonia, November 6:

On the 29th of October a fire on section 36 burned over 400 acres and destroyed 20 tons of hay; damage $80. It was extinguished in four hours by eight persons with water and wet sacks. Weather for about a month has been dry and windy.

Same, November 15:

The fire of October 10th which damaged Henry Brufladt, living on section 4, township 162, range 44, started as nearly as I can trace it on the northwest quarter of section 33, township 161, range 44. A prairie fire was started at 11 a. m., and it burned over 1200 acres of swamp and meadow. The weather was dry and windy and had been dry for about two weeks. It did damage to the amount of $200 to Henry Brufladt by burning 50 tons of his hay.

John Dietz, Fire Warden, town of Polonia, May 9:

May 7th a fire set to clear land before breaking burned over 40 acres and did damage to the amount of $50. It was extinguished by three persons with sacks and blankets. It came within 100 feet of buildings. The weather was very dry and windy and it was very hard to stop the fire, but we did it.

TRAVERSE COUNTY.

John Keaveny, chairman, town of Tintah, August 24:

Two days ago threshing was done close to the right of way of the public road and straw lies two feet in depth on public highway. A cigar stump thrown from the hand of a careless smoker would start a fire which with a south wind would perhaps burn all the town that lies west of the railroad track in the village. It looks very risky.

A splendid stand of primeval white pine on rocky non-agricultural land near Hibbing. Illustrates a leading principle of forestry, namely, that land unfit for agriculture can yield a handsome and sustained revenue if devoted to forest. In the present ways of lumbering, such land after being cleared is left a desert waste. Photographed, 1898, for the annual report of the Chief Fire Warden of Minnesota, and reprinted from his fourth report.

[He was instructed that there is a provision in the statutes against encumbering a highway, and that, if he would report the facts to the county attorney with request to act, he would undoubtedly adopt proper proceedings to remove danger; also that he was required by section 6 of the fire warden law to take "precautions to prevent fires," and when the weather was favorable he could cause the straw to be burned.]

WADENA COUNTY.

N. R. Carper, chairman, town of Wing River, May 1:

At this time of the year there are numerous fires. People generally burn their meadows, and sometimes the fire gets away and occasionally burns a stack of hay. Now these fires are in every direction. There is no timber here of any value except for fire wood. Only the other day there were many fires, and one man lost his hay. I did not learn of it for a couple of days. Please inform me as to the best course to pursue.

[He was instructed to use his best discretion and go to any fire if he thought the occupant of the land was a person liable to be careless.]

WILKIN COUNTY.

Herman Buth, chairman, town of Manston, June 24:

On the 4th of April, a fire in the west half of the town, which came across section 36 in the town of Mitchell, burned over 10 sections and destroyed hay, grain and bridges; damage $200. It was extinguished by ten persons plowing and breaking and beating with sacks and water.

G. J. Czicholzki, chairman, town of Mitchell, June 30:

A fire April 4th burned over a narrow strip of section 14 but destroyed nothing. It was so close to the town line it was hard to tell in what town it started.

Walter Peake, chairman, town of Prairie View, November 24:

September 24th a fire on section 33 caused by sparks from a railroad engine burned over 80 acres of prairie and destroyed about 10 tons of hay; damage $25. This was the only fire we have had this year. Dry weather at that time.

Laws of Different States for the Prevention of Forest Fires.

MAINE.

The law of the State of Maine of March 25, 1891, constituted the Land Commissioner as Forest Commissioner, with $200 increase of salary, which amount was doubled in 1903.

The selectmen are made fire wardens in their towns, the town to be divided into three districts according to roads, streams or lot lines, of which the town clerk shall make a permanent record, and a fire warden is assigned to each district. Their services are to be paid at the same rate as other official service, but no town is to pay for extinguishing forest fires in any one year an amount greater than two per cent upon its valuation for taxation. Those who assist in extinguishing fires are paid by the town, but not exceeding fifteen cents per hour.

For unorganized places the county commissioners may appoint not exceeding ten fire wardens in any one county, with same power as in towns, to be paid the same rate as in towns, the county to pay one-half of the expense, and the owner of the land on which the fire occurred the other half.

Any person who builds a camp or cooking fire on or adjoining any woods and fails to extinguish it is liable to a fine not exceeding $100 or imprisonment one month.

The Forest Commissioner, with the advice of the Superintendent of Public Instruction, shall take measures for awakening an interest in behalf of forestry in the public schools, academies and colleges, and of imparting some degree of elementary instruction upon this subject therein.

Important new legislation was enacted by Maine in 1903. The law of March 26, of that year, made it the duty of the Forest Commissioner to appoint forest wardens "in all plantations and unorganized townships," who are to patrol the forests, prevent and extinguish forest fires and to hold office during his pleasure. They are to receive $2 a day for each day of actual service, and may summon to their assistance citizens, to be paid fifteen cents for each hour of service. All expense incurred to be paid from the funds appropriated for the Forest Commission. The legislature of 1903 appropriated, as an "emergency fund for the prevention and extinguishment of forest fires," $10,000 for the year 1903, and the same amount for the year 1904. It also appropriated for "public instruction in forestry" $2,500 for the year 1903 and an equal amount for the same purpose for the year 1904. These amounts are in addition to the appropriation for the expense of the Forest Commissioner's office.

CONNECTICUT.

The law of Connecticut of June 17, 1901 (chapter 175), required the Board of Control of the Agricultural Experiment Station at New Haven to appoint "a man qualified by scientific training and practical experience to be State Forester," with authority to buy land in the state "suitable for the growth of oak, pine and chesnut lumber, at a price not exceeding $4 per acre," and to plant the land with seeds or seedlings of such trees, or such other trees as he may deem expedient, at a cost not

exceeding $2.50 per acre. He was required to protect such lands from forest fires, from trespassers, etc. The sum of $1,000 annually was appropriated for carrying out the provisions of the law. The law was amended by the act of June 3, 1903, by striking out the limitation of expense for planting the land with seed or seedlings and by adding a provision to allow him to employ such local assistance as he deems necessary for the protection of the land from fire or trespass.

NEW YORK.

The State of New York in 1885 made town supervisors fire wardens, and that system was in use until 1896, when the Forest, Fish and Game Commission was authorized to appoint a fire warden for each town in the sixteen counties containing land belonging to the forest preserve. In the other towns the supervisors still act as fire wardens. The pay of fire wardens is $2.50 per day during the time they are on duty, and those who assist in the prevention and suppression of fires are paid $2 a day. The expense of fire warden service is paid by the town in which the service is rendered; and the state pays the towns one-half of such expense. The office of Superintendent of State Forests was created at the beginning of New York's forestry system. His salary is $3,000 a year. In 1900 the office of Chief Fire Warden was created, with a salary of $1,500 a year. He has supervision of the town fire wardens. The state also employs three forestry experts. The appropriation for the salaries and expenses of these five officers in 1903 was $12,800; and for one-half of the town expenses in suppressing fires $5,000. These items of course do not include printing expenses nor for any experimental field work.

NEW JERSEY.

The law of New Jersey of April 3, 1902, authorizes any city, township or other municipality to raise money for preventing, fighting and extinguishing forest fires; and where money has been so appropriated to appoint a suitable person as fire marshal, who may appoint deputies and aids to assist in the prevention and extinguishment of such fires, and who shall be paid reasonable compensation. He shall report concerning forest fires to the governing body which appointed him. It is made the duty of the justices of the peace to investigate the origin of fires, and they are clothed with authority for such purpose; and if they find sufficient evidence they may have the offender held to await the action of the next grand jury. The fire marshal has the power of a constable, and he may serve the necessary papers in course of an investigation. The state appropriates twice the amount raised by any municipality for the prevention and extinguishment of forest fires, provided that the amount paid by the state to any one municipality in any one year for such purpose shall not exceed $200; and provided that the total amount paid by the state in any one year shall not exceed the sum of $10,000.

PENNSYLVANIA.

In Pennsylvania the constables are made fire wardens. The towns there first pay the expense and the state pays one-half. There is a Forestry Commissioner and a Forestry Reservation Commission, of which the Forestry Commissioner is president, that is authorized to purchase any suitable land for forest preservation at not exceeding $5 per acre.

The appropriations made by the legislature of Pennsylvania for the department of forestry for the two fiscal years beginning June 1, 1903 (and not including expenses

for preventing and extinguishing forest fires), amounted to $23,216. In addition, the expense of printing and binding eight thousand copies of the report of the department of forestry for each of said fiscal years is to be paid out of the printing fund. Also the law of May 13, 1903, appropriated $16,000 to erect buildings on the Mont Alto State Forestry Reservation and to provide practical instruction in forestry therein; the instruction not to cost exceeding $10,000 for the two fiscal years ending June 1, 1905.

The Act of April 15, 1903, limits the amount of money which the State Forestry Reservation Commission shall expend for the purchase of land for forestry reserves to $300,000 a year.

MICHIGAN.

The legislature of the state of Michigan has enacted a law which was approved June 18, 1903, and which, with a few exceptions, is a copy of the Minnesota fire warden law as it was previous to the amendments adopted by the last legislature. The exceptions are these: The law applies only within the territory lying north of the north line of township 20 north. It makes the Land Commissioner Forest Commissioner, and authorizes him to appoint a deputy to be known as the Chief Fire Warden, and who receives a salary of only $500 a year; persons who are employed to assist in extinguishing fires are paid $2 a day; services of fire wardens and helpers to be paid by the town—state to pay one-third. Where a town embraces more than one surveyed township, the supervisiors may appoint a fire warden for such additional township.

WISCONSIN.

The last legislature of Wisconsin enacted an important forestry law, which was approved May 22, 1903. It

establishes a department of State Forestry with a board of five commissioners, consisting of the Attorney General, Secretary of State, State Treasurer, and two to be appointed by the Governor, who are authorized to appoint a Superintendent of State Forests, with a salary of $2,500 a year, and who is ex-officio Forest Warden. It is his duty to enforce the law for the prevention and extinguishment of forest and marsh fires and to appoint one or more fire wardens in each town in twenty-nine of the northern counties which are named. They can summon any resident of the town or immediate vicinity to assist in preventing or extinguishing fires. Fire wardens and those who assist in extinguishing fires are paid not exceeding twenty-five cents per hour, which shall be paid out of the treasury of the town in which the service is rendered, but not exceeding $100 for each town of thirty-six sections shall be paid in any one year. Fire wardens are to be paid not exceeding twenty-five cents per hour for posting notices furnished by the superintendent.

"All public lands remaining unsold and all lands so withdrawn from sale and such other lands as the state may hereafter acquire for that purpose shall constitute the State Forest Reserve."

The Superintendent of state forests is to establish one or more experiment stations on lands that belong to the state forest reserve, for the purpose of conducting researches into the best methods of forest management under the conditions prevailing in the various portions of Wisconsin.

He is to remove and sell all dead and down timber on the reserve.

The sale of all lands belonging to the state except lands that are in fact swamp lands and lands suitable for agriculture, wood lots convenient to farm homes and isolated tracts, not exceeding 80 acres each, shall cease after this act shall have gone into effect.

The sum of $3,000 is appropriated to carry out the provisions of the act, in addition to the salary therein provided.

COLORADO.

The law of Colorado of April 11, 1903, makes sheriffs, under-sheriffs and deputies fire wardens of their respective counties in case of prairie or forest fires, and empowers them to call to their aid in extinguishing such fires such persons in their county as they may deem necessary. The sheriff is paid $5 a day for such services and his deputies $3 a day; the county commissioners to allow the same; and such other expenses as they deem just.

The Forest, Fish and Game Commissioner of Colorado receives a salary of $1,800 a year, and $4,500 a year is appropriated for the salaries of "Forest and Game Wardens."

WASHINGTON.

The devastating forest fires which prevailed in the State of Washington in the fall of 1902, led that state to enact the law of March 16, 1903, "to protect forests from fire." It constitutes the State Land Commissioner as ex-officio State Forest Fire Warden. County Commissioners may appoint deputy fire wardens, prescribe the territory to be patrolled by them and fix their compensation. State land cruisers are made ex-officio forest patrolmen. The State Forest Fire Warden is to enforce the law and investigate the origin of forest fires. County Commissioners in timber counties may fix a close season during which any person shall not burn any slashings or choppings without first obtaining permission in writing from the county board. Fire wardens must patrol their districts, post warning notices, warn campers or other users of fire and impress help to stop fires. The State Forest Fire Warden must enforce all laws for the protec-

tion of forests within the state and investigate the origin of all forest fires. "Any person who shall on any land within the state set or leave any fire that shall spread and damage or destroy property of any kind, not his own, shall be punished by a fine of not less than $10 nor more than $500."

The expenses incurred in carrying out the provisions of the law "shall be met as other expenses of cruising or caring for the state lands." The items in the appropriation act for the two years ending March 31, 1905, out of which one must suppose these expenses are to be paid, are as follows, namely: "Salary and expenses of agents selecting lands, and United States Land Office fees, $12,000. Appraisement, sale and lease of state lands, $20,000."

ONTARIO.

The Province of Ontario having more than twice the territorial extent of Minnesota, with extensive forests, her system of fire prevention should be of particular interest. As early as 1878 a law for the prevention of forest fires was enacted, but, not providing means for its enforcement, it became, to a great extent, a dead letter; and in that condition matters remained until the year 1885, when a system was devised by the Crown Land Department for the employment of rangers to be appointed by that department on the recommendation of the "timber licensees" or lumbermen—the lumbermen to pay half the expense of the service and the government half. For some years the government advanced pay for the whole cost and undertook to collect one-half of the expense from the lumbermen, but now the lumbermen pay their half direct to the rangers. The system remained simply one of practice until the year 1900, when it was enacted as a law. Under this law, for the prevention and suppression of fires on the lands of the Crown not under timber license,

the Commissioner of Crown Lands may appoint such number of persons as he may see fit, to be called fire rangers, who shall be subject to his instructions, and may pay them for their services out of any moneys voted by the Legislative Assembly therefor. Where Crown lands are under timber license or other form of authority to cut or remove the timber therefrom the Commissioner may appoint such number of fire rangers as the timber licensee or holder of such other form of authority may request, and in the absence of such request the Commissioner may appoint such number of rangers as the public interest requires; "and in such cases one-half of the remuneration to be paid such fire rangers and one-half of the expenses necessarily incurred by them in the performance of their duties shall be payable by the licensee or holder of authority as aforesaid, and one-half by the said Commissioner out of the moneys voted by the Legislative Assembly for the purpose; or the said Commissioner may pay the whole amount of such remuneration and expenses, and may charge the timber licensee or holder of authority as aforesaid with one-half the said amount, which shall be and remain a charge on the timber limit or other area covered by said authority until paid, as fully and effectually as if the same were for unpaid timber dues or ground rent, and in respect of the recovery thereof the said Commissioner shall have all the rights, powers and authority now possessed by him for the recovery of unpaid timber dues or ground rent under the Crown Timber Regulations or otherwise."

The fire rangers are required to enforce the law "and in all cases coming within their knowledge to prosecute every person found guilty of a breach thereof." They may summon such help for the prevention and suppression of fire as they may deem necessary, and all persons so summoned and helping shall receive such remuneration

Lake Superior Forest Reserve. View from elevation of 70 feet on south bank of Isabella River, July 12, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota.

as the fire ranger or rangers may deem proper. The fire rangers shall perform such other duties and receive such wages as may be provided by regulations to be made under the Act by the Lieutenant Governor in Council.

By order in Council the government can appoint a ranger as magistrate, if competent, and he is able to appoint his assistant a constable to assist in arresting and bringing to justice people who violate the Act. The Ontario system appears to give good satisfaction. In 1886 the number of rangers employed was 45 and the cost $9,847, half of which was borne by the licensees. The service grew so that in 1902 the number of rangers was 234 and the government's part of the expense was $34,200. Forty fires were reported that year and 10,000,000 feet of pine were damaged, the estimated loss being $10,000. In 1903 the government's part of the expense was $31,257. The number of rangers employed was 270—May 1 to September 30—of whom 244 were employed on licensed lands, the licensees (timber cutters) paying half the expense.

There is another law in Ontario by which on the petition of one-third of the ratepayers a town may appoint not less than two fire guardians to prevent and extinguish fires set on land.

MINNESOTA.

It will be seen from the foregoing that there was important legislation in several states in 1903 for the prevention and extinguishment of forest fires. The effect of such legislation will be watched with interest. The system in Ontario appears to be one of the most liberally sustained of any. I think the criticism which an experienced legislator would make of some of the systems would be their failure to sufficiently provide for the payment of fire warden service. It has been my impression that towns would not have money in their treasury for the

payment of fire warden expenses unless the money were specifically raised for the purpose. To raise money for such purpose would require a vote at the annual town meeting and the proposition might fail just in the towns where the money was most needed.

The Minnesota system makes the State Auditor Forest Commissioner and authorizes him to appoint a Chief Fire Warden to represent his authority. Supervisors of towns, mayors of cities and presidents of village councils are constituted fire wardens. Chapter 64 of the laws of 1903 changes the manner of electing supervisors, so that after three years from now each will hold his office for three years instead of one year as heretofore. The act provides that "there shall be elected in the year 1904, at the annual town meeting in each town, three supervisors, one of whom shall be elected for three years, one for two years and one for one year, so that one shall go out each year. * * * At each annual town meeting thereafter one supervisor shall be elected for three years to fill the place of the one whose term expires at that time." This law secures increased experience in the supervisors, and of course should make them more efficient as fire wardens.

In unorganized territory the Chief Fire Warden appoints necessary fire wardens, and he may appoint needed fire wardens in any organized town. In brief, the fire wardens are to take precautions to prevent fires, post notices, warn those whom they think are liable to be careless, patrol or cause to be patrolled their districts in dangerous weather, go to and extinguish forest or prairie fires when they occur, and they have power to call to their assistance any able-bodied male person over 18 years of age. They are to make complaint before a justice of the peace against anyone carelessly causing a fire where they have information of facts that will probably sustain the same.

The chairman has to inquire into the cause of each fire without delay and immediately report the same to the Chief Fire Warden with other facts. Fire warden service is paid for in the first instance by the county commissioners, and the state afterwards pays the county two-thirds of the amount. Besides, the law carries an annual appropriation of $5,000 to enable the Chief Fire Warden to prevent or suppress forest and prairie fires, "during a dry and dangerous season, when forest and prairie fires are prevailing or are liable to break out"; also an annual appropriation of $1,000 to enable him to ferret out and prosecute violations of the law where local authorities neglect to prosecute them. This is but a short summary of the law, which was strengthened by twelve amendments enacted by the last legislature, and which were printed in full in my previous report.

I think the principal weakness of our Minnesota system has been the uncertainty of pay for fire warden service. In a few counties the commissioners have in previous years arbitrarily refused to pay for any service. In other counties fire wardens have been humiliated by having accounts that were already small unreasonably cut down. I must say that the service has been considerably impaired by the illiberal action of county commissioners. I have heard quite able and experienced men say that it would be better if the state were to pay the whole expense. However, the tendency appears to be towards more considerate action by county commissioners, and now that the state pays two-thirds of the expense I think it may be hoped that the fire wardens will be promptly and fairly paid for their services. Anyhow the new provision of law should have a fair trial.

Expense of Minnesota's Fire Warden System.

The State Auditor's printed reports show the expenditures under the fire warden law. The expenses which the various counties have incurred under the law has averaged only $2,000 a year, and the expense which the state has incurred has averaged about $6,000 in round numbers. Total $8,000; of which at least $1,500 a year has been incurred for printing. We have seen that the expense of Ontario's system for preventing and suppressing forest fires amounted to, in 1902, $68,400, half of which was paid by the Government. For actual work in the field, therefore, Minnesota has expended only about a fifth part as much as the Government of Ontario. I am satisfied that if the appropriations for fire warden service were more liberal, and if fire wardens could be certain of reasonable compensation, the service would be more efficient.

The reports of fire wardens during the eight years that the fire warden law has been in operation show that the number of acres burned over by forest fires amounted in the aggregate for the eight years to 370,613, but consisting mostly of cut-over land and meadows; and that the damage amounted in the aggregate to $251,602, being an average of $31,200 per year.

Very Dangerous Weather.

Let us imagine that we are in the midst of a very dangerous season; that there has been no rain for about a month and that everything in the woods is in a combustible condition. Campers and tourists, hunters, land seekers, mineral prospectors and cruisers are all active, and in hundreds of places some new settler may be engaged in clearing land. The risk of fire will be very great. Under such conditions what are the fire wardens to do? They should have seasonably warned any care-

lessly disposed persons against setting fires; they should cause their districts to be patrolled as they have authority to do, and they should be especially active in having any forest fire extinguished at the earliest moment and before it gets beyond control. But suppose a fire has gained considerable headway and is burning over several acres of fallen timber and slashings and is really such a fire as cannot be extinguished? If a gale should rise such a fire would be likely to spread and cause disaster. Then in such a case the fire wardens should try to have plenty help, and before the wind has risen go a sufficient distance in advance of the fire and make an extra sufficient fire break. This had better be done in the evening or very early in the morning, when the weather is likely to be calm. In making a fire break in such case advantage should be taken of any natural formation, such as a stream, hillside or road.

The fire wardens of a town should, before there is danger of any fire, carefully consult together and agree upon the best plan of action to be taken at a critical moment. They should be just as well prepared as possible for an emergency, and if they seasonably think the matter over seriously they will realize how important is the prevention of fires. One thing which they certainly can do is to make themselves familiar with the fire warden law, so as to know what their duties are.

Town supervisors as fire wardens now have plenty of authority, and they will be responsible for dangerous fires originating in their town.

Under the present law fire wardens and those who assist them can be reasonably sure of their pay. The state, as before said, now pays two-thirds of the local expense which counties incur for fire warden service; and there is besides a fund of $5,000 which the state will directly expend if necessary for the prevention and extinguishment

of fires in a dry and dangerous season. This, it must be remembered, is for an extraordinary season. For ordinary seasons the appropriation, as I have stated at the beginning of this report, should be increased.

WHAT IS FOREST PRESERVATION.

The greater part of the standing timber in this country belongs to private owners, who will cut it as fast as they find a good market.

When a timber tree has ceased to earn good interest by its growth, it has reached its fiscal age, and ought to be cut.

What we mean, then, by forest preservation is the protection of forests from fire, the reservation and treatment on forestry principles of such of the remaining public timber lands as are better adapted for forestry than for agriculture, and the acquisition by states by purchase of any considerable tracts of private nonagricultural lands in their limits, especially at the sources of rivers, and holding and using the same for forestry.

Strictly speaking, forestry looks only at dollars and cents. At the same time, it yields indirect benefits which concern everyone. The forest beautifies landscape, improves climate, enriches soil, maintains water courses, makes covert for game, affords means of recreation.

The significance of forestry is that it utilizes waste land—land that is too hilly, too rocky or too sandy for agriculture. If a forest of pine should now be started on such land it would in eighty years reach merchantable size. The population of this country increases eighteen per cent every ten years. By the time the forest had matured our population would be 287,000,000. What an increased demand for forest products at that period!

The Original Pine Forests Disappear.

One of the richest pine timber regions of the northwest was the Saginaw and Huron Shore districts of Michigan. In 1893 there was cut in that district, 858,000,000 feet of pine; but the supply of pine timber had so diminished during the next ten years that in 1903 only 52,000,000 feet were cut. The number of feet of pine logs cut in Minnesota the season 1902-1903 was 2,000,000,000. The amount of pine lumber cut in the year 1903 by the mills in the districts of Duluth, Minneapolis, above Minneapolis and St. Croix was 2,200,628,000 feet; being over two billion feet. A comparatively small amount of this may have been from the forests of Wisconsin. A liberal estimate places the remaining standing pine in Minnesota at 28,000,000,000 feet. Anyone can judge for himself therefore, how soon this forest capital will be exhausted and say whether it is not time to begin a system of reforestation by utilizing waste land in the production of pine timber.

Practical Forestry.

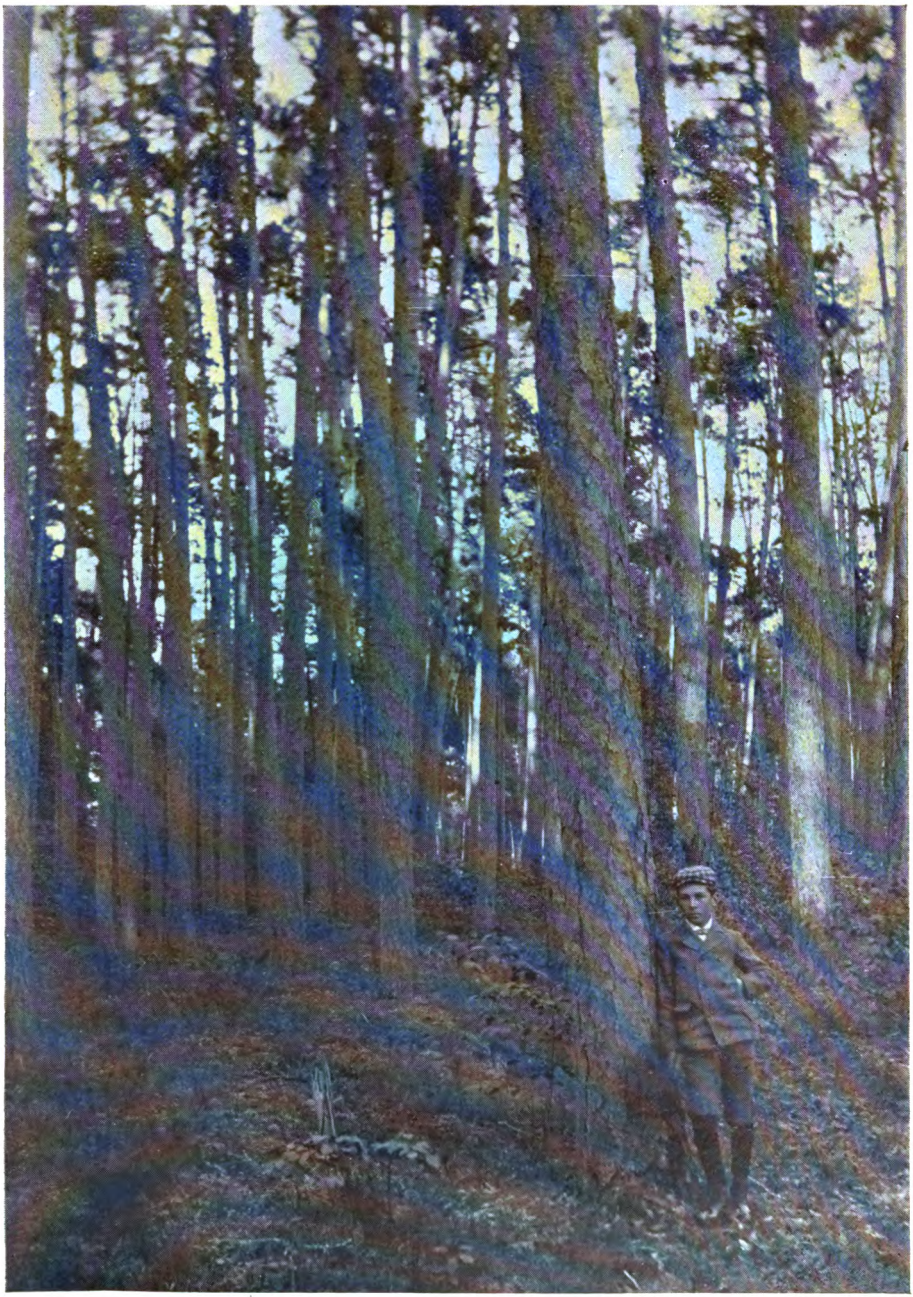
In a certain sense it is forestry when we cultivate trees for a wind break on the prairie or to add beauty to a lawn or to prevent the earth from washing away on steep hillsides; but strictly speaking forestry is the science of raising timber trees for profit. Forestry is the science of deriving good money returns from land which cannot profitably be cultivated in raising grain or other field crops.

Let us suppose that the state or some institution of learning holds a thousand acres of natural forest, that it does not need to convert the timber immediately into money but is able to treat it on scientific forestry principles. Now, how will it begin to manage this forest?

That depends upon the character of the soil, the size of the timber and the condition of the lumber market. An examination of the forest by a skilled forester shows that 500 acres, or one-half of it, consists of mixed pine and hardwood timber growing on good loamy soil with clay subsoil suitable when cleared for agriculture; and that the other half consists of wholly pine forest on soil that is too sandy for agriculture.

We are to assume all the while that this forest is to be treated so as to yield, not for to-day only, but for a long series of years, the largest financial return without impairment of the capital; in other words, we are not to kill the goose that lays the golden egg. Very well, how then shall we proceed? We are to suppose that the half of the forest on good soil contains yellow birch, basswood, maple, poplar and some oak trees, mixed with considerable pine; and the pine is from 80 to 100 years old, of good merchantable size, and that it is not earning by its growth more than about two per cent interest on its value; that most of the hardwood trees are mature, that many of them are suitable for timber and the balance good for fuel. Now, it is plain that if these trees are within reasonable reach of a market and there is a fair demand for such timber then they should all be cut and their value turned into money at the first convenient period, and that the land on which they stand should be used in the future for raising wheat, grass or some other field crop. Because, of course, a larger income can be got from the land in raising annual field crops than in raising crops of trees, which on such land would require 50 years to reach merchantable size.

Now, about the other half of the forest on sandy soil which is too light for farming purposes. On these 500 acres we find that the trees are mostly red pine, commonly called Norway pine (improperly so-called however,



An ideal forest of Norway pine and thick undergrowth of white pine, from one to three feet high, on the island in Cass Lake. Photographed, September, 1900, for the annual report of the Chief Fire Warden of Minnesota.

because the pine of Norway is the same as the Scotch pine), and here and there a few white pines. The trees are for the most part only about fifty years old, stand pretty close and are earning fully five per cent interest net by their growth. The proper thing to do with them therefore is to let them remain about thirty years longer, at the end of which time they will be from 12 to 15 inches in diameter breast high and can then be cut and sold to the best advantage. At that period they can be said to have reached their fiscal age, because after trees are eighty years old their growth is too slow to yield good interest. As the soil is only fit for bearing pine these trees when cut should be succeeded by another crop of pine, and so on perpetually; and doubtless the best economy will be to cut them gradually, fifty acres or so a year, —and beginning always on the side opposite to the prevailing winds—so that the ground can become reseeded from the adjoining trees and a new crop raised naturally. If, however, a new crop does not start naturally, then cutting must be followed either by sowing seeds in spots, three to five feet apart over the ground, or by planting seedlings or transplants about the same distance apart. If young trees come up naturally from the seed as abundantly as they should there will be about one thousand trees on each acre when they are 40 years old; at which age if a thinning is made by cutting and removing the poor, deformed and diseased trees the rest will grow in a more thrifty manner.

Of course care must be taken that this perpetual forest shall not be damaged by fire. A good plan for this object would be to maintain a road around the forest.

Managed according to forestry principles this 500-acre tract of sandy non-agricultural land will perpetually yield three per cent net compound interest annually on the capital it represents.

A NORMAL FOREST.

The best treatment, however, of this five hundred acre tract of perpetual forest would be to get it into the condition of a normal forest at the earliest practicable period. A normal forest is one that is fully stocked, that contains different age classes of trees, so that enough mature trees can be cut annually or in a certain series of years to yield a steady income on the capital invested without impairment of the capital. The rotation period for pine on such soil should be eighty years; and as soon as this forest is in a normal condition six and a quarter acres of mature timber can be cut annually for ever. An acre of such forest should, at the end of its eighty years' growth, yield on an average 20,000 feet board measure. The yield of six and a quarter acres therefore would be 124,000 feet, which at $5 per 1,000 feet would amount to $620 as the annual gross income from the forest, exclusive of intermediate thinnings and fishing and hunting privileges. From this gross income of $620 deduct $124 as the annual average expense of care of the forest, also taxes (which on sound principles should only be on the revenue), and we have left $496 as the net amount of annual interest, at three per cent, on a capital of $16,530, representing the value of the forest.

Forestry enjoys this advantage over agriculture: The field crop must be harvested when ripe, even though market prices are ruinous; but the forest crop can stand and grow, if only a little, till prices are good. It may be expedient not to cut our regular six and one-quarter acres of forest each year, but wait ten years, or even longer, and then, when the market for timber is very good, cut enough to make up for the inactive years.

To bring a forest into a strictly normal state the following rule, cited by Professor William Schlih (Manual of Forestry, vol. 3, page 318), can be followed: "If the

normal growing stock is present in a forest, then the actual, or real, increment must be utilized; if the real growing stock is greater than the normal, more than the real increment must be removed; if the real growing stock is smaller than the normal, less than the real increment must be utilized until the deficiency has been made good."

NURSERIES.

If one has to plant many acres with pine or spruce trees it will be economical to raise them in a nursery. In such case the ground for the nursery should be prepared with the same care as for a vegetable garden, but should not be manured. Good natural and rather light loamy soil is the best for a nursery. Seed should be sown in beds, and in rows four to six inches apart, after the frost is out of the ground in the spring and when the ground is not wet. As young coniferous plants are very delicate and liable to be killed by the sun unless shaded, a screen, either of laths or of brush, must be kept over them during the first weeks after they are up. While they remain in the original bed the plants are called "seedlings," but they should not stay in the original beds longer than two years. When one or two years old they can be planted on the ground where they are to remain, or they may be planted and remain one year in other beds, when they are called "transplants," and then planted for forest. Planting had better be done in moist weather. The skilled workman never allows the hair roots of plants or trees to be exposed even for a moment to the sun or dry air.

What Forestry Means for Minnesota.

What forestry means for Minnesota is simply this: The remaining original pine timber will be cut in the next fifteen years. Some second growth pine, if protected

from fire, will then be cut from year to year, but it will not be as good as the original growth and there will not be enough of it for home consumption. Lumber will be dearer and our great lumber industry will decline. There are, however, fully three million acres of waste land in scattered localities which if planted with pine would in time become normal forests, yielding forever a supply sufficient for our home need. Such forests would by their growth perpetually yield a net annual revenue on the capital invested of three per cent, compound interest, besides many indirect benefits. On such waste, sandy land it will take on an average about eighty years for a crop of pine trees to grow to merchantable size. Individuals cannot wait so long for a crop and they will not engage in the business. The state, to whom time does not occur, must undertake the work by purchasing waste land and planting it with pine. The Minnesota forestry board is ready to go to work, but, until there is some man in the legislature who will make forestry a specialty and fight for it with energy, we shall not get the necessary money for forestry.

RANK WHICH FORESTRY SCIENCE CAN GIVE OUR COUNTRY.

When thirty years ago the United States sent her naval vessels over distant seas to observe the transit of Venus, Europe gave her the highest praise for such sacrifice for science. Wherever Americans have profited by science they rank with any other people. To keep our army and navy up to date we have maintained scientific military and naval academies for a long period. Homage is paid to our ships of war abroad because our naval service has had every benefit that science could furnish. So, when our forests shall have had scientific care for a sufficient time we shall rank with the most advanced countries in forestry. "A nation's character," said Henry Clay, "is

the sum of its splendid deeds." To clothe the waste places of our country with thrifty revenue-yielding forest would be a splendid deed!

NATIONAL FOREST RESERVES.

The compiled statutes of the United States, page 1539, provide that "no public forest reservation shall be established except to improve and protect the forest within the reservation or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States; but it is not the purpose or intent of these provisions, or of the act providing for such reservations, to authorize the inclusion therein of lands more valuable for the mineral therein, or for agricultural purposes, than for forest purposes."

Any mature timber in a United States forest reserve may be sold at its appraised value. Any person, under the regulations of the Interior Department, can enter a forest reserve for all lawful purposes, including that of prospecting, locating and developing the mineral resources thereof; and, more than that, can have free use of timber and stone carrying on his work. Besides, the Interior Department may restore to the public domain any public lands in a forest reserve, which, after due personal examination by a competent person, shall be found better for mining or for agricultural purposes than for forest use. The setting apart of lands that are suitable for the purpose as a forest reserve is, therefore, beneficial to the public, though it may not be beneficial to the speculator in timber.

FORESTERS NEEDED.

Some of the brightest young men in Minnesota are studying forestry. The United States government will soon want fully 300 trained foresters to have charge of the

national forest reserves. There are now 62,000,000 acres of such reserves in the Rocky Mountains and farther west, and they are likely to increase. A trained forester is to have charge of a range not exceeding on an average about 170,000 acres—depending somewhat on natural boundaries—at which rate there should be employment now for 360 foresters or chiefs of range, to manage properly the present reserves. But at present there are probably not more than thirty foresters in the country qualified for the position.

Forestry promises to be one of the most attractive of scientific careers for young men in this country. It is a profession in which the tenure will be permanent and the service fairly well paid; but it will require, of course, years of hard study to become qualified for the service. A forester should be a good practical surveyor. He should know how to measure trees and estimate their contents, how to make a map of the forest and necessary roads, how to make and execute working plans for the forest and to manage the same in a way to secure a sustained yield. Besides technical knowledge of trees and tree culture, he must be acquainted with the kindred sciences, such as agriculture, geology, mineralogy and botany. He must know how to protect the forests from the ravages of insects as well as from fire and trespass, how to get rid of noxious animals and how to protect valuable game. These are some of the things he must know.

Assuming that a boy had graduated at the high school, he ought in four years of study and practice, one of which should be a year of practice in the woods, to become a fairly competent forester. With such training I think he would be sure of $1,200 a year as a forester in the service of the United States, with the prospect of rising in his profession for distinguished merit.

Shore of Bald Eagle lake, Lake Superior Forest Reserve, July 11, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota.

The appropriations which congress made for the present fiscal year for the care of forest reserves and for the forestry bureau amounted in the aggregate to $892,000.

LAKE SUPERIOR FOREST RESERVE.

Favored by perfect July weather, my trip into the wilds of Lake County was through a region that could well be called Minnesota's Adirondacks. Embarking four miles east of Ely in two modern canoes, with an experienced canoeman for each, and with a photographer, the route was via the Cashaway and Birch rivers, Gabbro and Bald Eagle lakes, the Isabella river, Lake Bellissima, Elbow and intermediate lakes to Cross river, thence to its mouth at Lake Superior; traversing parts of eleven townships, five of which are unsurveyed, and most of the country being in the proposed Lake Superior Forest Reserve. The surface is undulating with elevations varying from 1600 feet to 2200 above the sea. Granite ledges are frequent and granite boulders often fringe the banks of lakes and streams. The country generally is a handsome primeval forest, with some swamps of dwarf spruce and burnt areas interspersed, the prevailing kind of trees being spruce, balsam, jack pine, white birch, poplar, cedar and tamarack. There is but little of white and Norway pine. Alder bushes abound in low places and along river and lake shores. The ash, elm and maple are seen in more fertile spots, but not frequently. A few spruce and cedars were seen that were a little over two feet in diameter, breast high, but generally the trees are not of large size so far as could be judged in travelling many miles through the woods in the twenty portages—some of which, on account of obscure trails, fallen trees and labyrinth of roots, were difficult. Climbing to an occasional height, an extensive view could be gained of the landscape. The sombre coloring of coniferous woods was relieved by

the lighter foliage of white birch and poplar, and the moving shadows cast by the clouds made an impressive scene.

The region is rich in lakes and streams. Bald Eagle lake, which is about three miles in length and wide in proportion, has such a handsomely wooded sloping shore and fine islands, and looked so cheerful on the bright summer day we entered it, that I thought its name could well be changed to the Lake of Smiles. Bellissima lake is still larger, with more islands and equally as beautiful. There are many other large, fine lakes, some of which are stocked with whitefish.

Over a dozen moose were seen on the trip, always near water, and nearly as many deer. Also ducks and partridges were seen. The country is fairly well stocked with fur-bearing animals, such as the black bear, martin, lynx, otter, beaver and fox. If set apart as a forest reserve the region would prove a great game and fish preserve, and no doubt a favorite resort for tourists. There is any amount of water power in the rivers, especially in Cross river, where the spruce could be made into pulp.

The forest reserve law provides for the utilization at its appraised value of all merchantable timber in a reserve. If any considerable area of agricultural land is found in a forest reserve it is to be restored to the public domain.

ALONG THE RAINY RIVER.

I went the latter part of September, fifty miles through a timber country on the line of the Canadian and Northern Railway from Beaudette to Warroad (on Lake of the Woods), in the northern portion of Beltrami and Roseau counties. The road has been in operation a year, but I saw scarcely any trace of recent fire along the line of route. This was the first time I had visited just that portion of the state, although it was the third time I had visited Rainy River. For the greater part of the distance

the land is suited for agriculture. I would except from the agricultural areas a few tracts that are exclusively in jack pine. It is generally level. The prevailing timber is poplar, then richly tinted and handsomer for scattered basalms and spruce. There are considerable bodies of good spruce; also of cedar and tamarack alternating with some inviting hardwood tracts. There is also some good pine, the manufacture of which at one place at least along the line of road has begun. This timber ought to have an increased value when the great water-power at Koochiching—now called International Falls—shall be developed. The agricultural character of the land and the quality and quantity of the timber along the line of this railway on the Ontario side are equally as good.

This railroad is developing quite an important part of northern Minnesota. The scenery of the Rainy River, the islands and shores of which are prettily wooded, is decidedly beautiful, especially after it has received the autumn coloring.

EUROPEAN FORESTRY.

No intelligent friend of forestry supposes that the science of forestry will, for a long time, produce in this country the results which are seen in many of the densely peopled states of Europe, but a knowledge of these splendid results is very instructive and stimulating, and for that reason I have taken pains to diffuse such information. The science of forestry is the same everywhere, but its application depends upon the conditions which are found in different countries. Let us assume that there is a natural coniferous forest on non-agricultural land in Germany in which 75 per cent of the trees are mature and 25 per cent have not reached merchantable size. According to scientific forestry the 75 per cent of mature trees will be cut just as soon as the market would justify and the 25 per cent of trees of unmerchantable size would be left to grow till they should be fit to cut. A similar natural forest in this country would be treated in the same way, if treated according to forestry principles; and some lumbermen, such as those, for example, who hold pine lands in the valley of the St. Croix river or on its tributaries in this state, and who have gone back every fifteen or twenty years to make a second, third or fourth cutting on the same land, are managing their forests in this way. In cases where pine lands are remote from streams of capacity for floating and where the pine is reached by temporary logging railroads, clean cutting is made of both large and small trees; but lumbering of this latter description is in violation of forestry principles. If a trained forester were to commence cutting a mature forest he would not begin on that side of it which is exposed to the prevailing wind, because if

he did every cutting would freshly expose the remaining forest on the side of the cutting to dangers from the wind. Instead of that he would begin on the side opposite the prevailing wind, leaving the forest border, long years hardened to the wind on the windward side, as a protection to the forest. Now, that is a principle of scientific forestry and is just as applicable in this country as in Europe. Again, a trained forester in Germany would manage the cutting so as to promote natural seeding from the nearest trees left standing, and that principle is just as applicable in this country as in Europe. If a person in this country were to begin to manage a natural forest on forestry principles he would first have it surveyed; he would ascertain the number, contents and situation of the mature trees; he would gradually make necessary roads; he would make a map of his forest and prepare working plans for its administration and ascertain where he could sell the mature trees at the highest price; these would be the essentials that he would perform, and he would be doing just the same as a German forester would do with a forest in Germany. Owing to the denser population, cheaper wages, better roads, and very much higher value of land and forest products, the results of forestry are very much different there from what they are in this country, or will be for many years. But the cause of forestry in this country will be greatly promoted by diffusing a knowledge of European forestry; and for that reason I reprint from my last report sketches—obtained at great pains and in many instances direct from the respective governments —of the forests and forestry of several European states. A few sketches have been slightly abridged.

BAVARIA.

STATE FORESTS.

Bavaria, whose attractive capital, Munich, is frequented by so many Americans, has 6,000,000 inhabitants. Its state forests comprise 2,150,000 acres, and are mostly managed as "selection" forests. Large forests are to be found in all parts of the kingdom; but as a general rule the mountainous districts in the south (Alps), the north (Spessart) and northeast (Bohemian forest) are covered with the densest forest. Of the whole area of the country 33 per cent is covered with forest. The prevailing kind of trees, or 77 per cent, are coniferous. The remainder comprise various kinds of deciduous trees—those losing their foliage in winter. Among the conifers, red and white pine are most frequent. Among the deciduous trees the beech occupies the greatest space. The oak is also cultivated quite extensively for tanning purposes. The average estimated value of the forest land is $50 per acre. The annual aggregate expense of administering the forests (1891) including salaries of officials, wages of workingmen, local taxation, new purchases, etc., amounts to $4,965,204. The total revenue from the forests the same year amounted to $8,187,349. Number of acres sown or planted to forests in 1892 was 14,800, more than three-fourths of which area was planted with coniferous trees. In the case of the red pine and the white pine, reforesting is mainly done in the natural way. In the case of the fir (*pinus sylvestris*) it is always effected artificially; in the case of the beech, always in a natural way (seed from standing trees); in the case of the oak, generally by artificial sowing. There is a continuity of forest products and a steady increase of the revenue which the state derives from its forests. This is due, first to an increase of prices, secondly to an increase of the yearly

crop. The latter must chiefly be regarded as a result of the present condition of the forests, which are being and have been steadily improved; also of the economy which was practiced in former times. Where reforesting is effected by seeding from the standing trees, the crop is generally cut in lengthy strips, usually not exceeding about thirty yards in width. As a general rule the administration of the state forests makes it a principle to avoid cutting in large blocks clean. In regard to compulsory tree planting, it may be said that every forest area, the trees of which have been cut, no matter whether state or private property, must be reforested in a short time, unless evidence can be furnished that the land would be better adapted to agricultural purposes.

The damage caused by forest fires is quite insignificant, being in 1890 only $974, in 1894 only $1,686. The principal cause of such fires is the carelessness of the workingmen employed in the forests and of individuals and parties making excursions, particularly on Sundays. There are no data at hand as to the number of such fires caused by railroad locomotives, and although some fires are no doubt so caused, the number is certainly very small.

The administration of the Bavarian state forests constitutes one of the departments of the ministry of finance. It is directly subordinate and responsible to the latter, no other authorities intervening. The highest forest official who may be regarded as being at the head of the forest administration, responsible, of course, as stated, to the minister of finance, bears the title "Ministerialrath,"—ministerial or cabinet councilor. The chief director of the Bavarian administration of state forests is "Ministerialrath" Ganghofer. His starting salary is 7,740 marks. After a sixteen years' service the salary advances to 8,820 marks. Next in rank are the so-called "Oberforstrathe," with a starting salary of 6,660 marks, which, after a sixteen years' service, is increased to 7,740 marks.

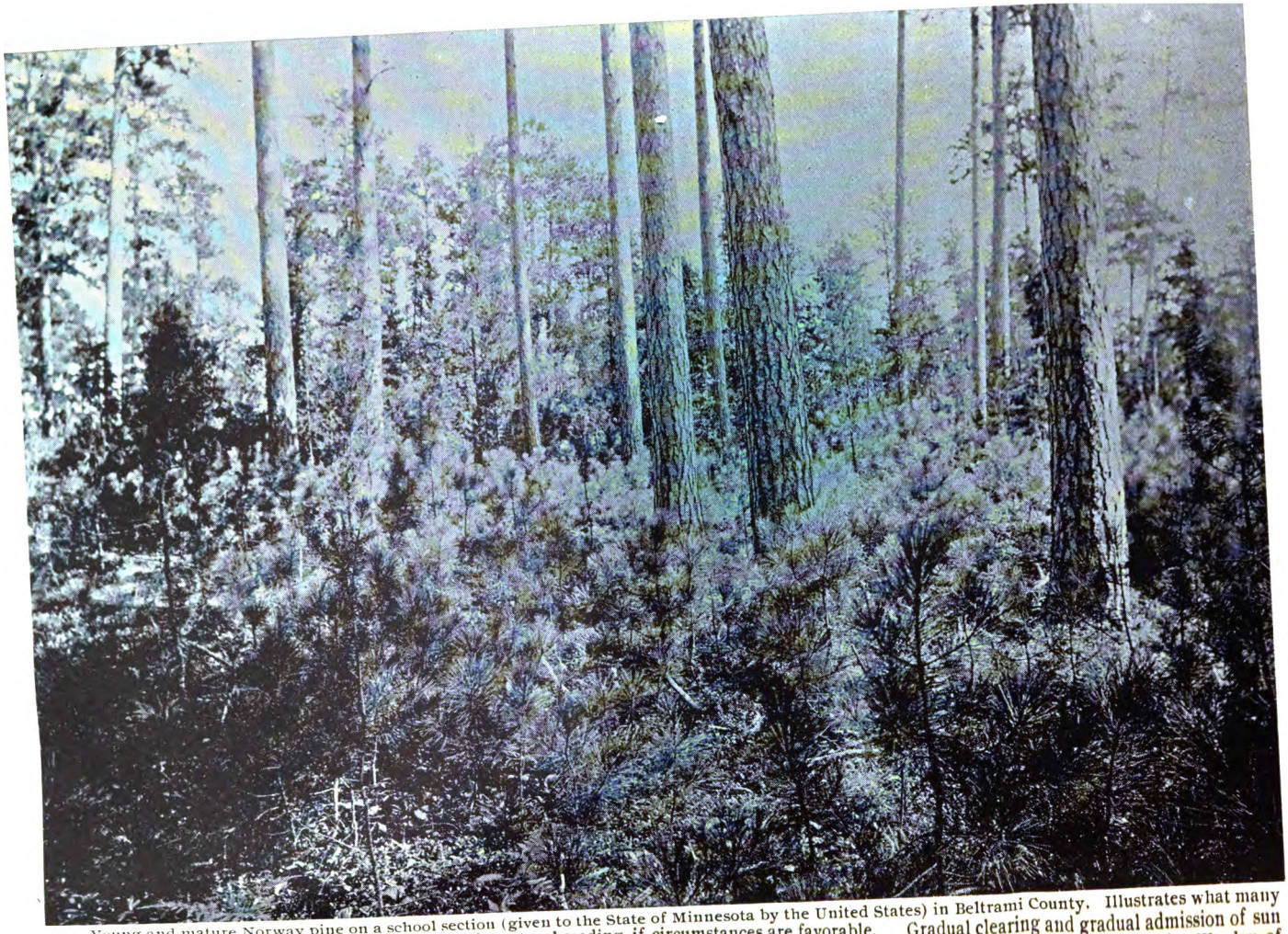
PRIVATE FORESTS.

The aggregate extent of private forests was 3,149,400 acres in 1892. In addition to the state and private forests there are about 800,000 acres of forests belonging to separate towns and villages. The forests which are owned by great landholders are managed on forestry principles. These forests, however, only comprise a very limited area, somewhat less than 400,000 acres. Most of the private forests are the property of small landholders. The average value per acre of private forests is somewhat less than that of the state forests. The net income rate varies widely. The data at hand are too few and too unreliable to admit of arriving at any conclusion with regard to the average. Opinions vary as to whether the total forest product of the country increases or decreases. In general the extent of the private forests seems to be somewhat decreasing. This would, of course, also appear to entail a decrease of the total forest product. Forest lands are only allowed to be changed into agricultural lands when proof can be furnished that the agricultural crop may be expected to exceed in value the forest crop. Between 1886 and 1891 7,000 to 8,000 acres of private forests were newly planted or sown.

DENMARK.

STATE FORESTS.

The experience of a country which had adopted important forestry regulations almost at the very beginning of the last century and which has successfully, through tree planting, resisted the invasion of desolating sand drifts from the sea shore must prove of much value. It was, therefore, with a high degree of satisfaction that I lately received from the Department of Agriculture of



Young and mature Norway pine on a school section (given to the State of Minnesota by the United States) in Beltrami County. Illustrates what many misinformed people deny, that pine will succeed pine by natural seeding, if circumstances are favorable. Gradual clearing and gradual admission of sun are generally followed by the springing up of young pines if fires are kept out. Photographed, 1898, for the annual report of the Chief Fire Warden of Minnesota.

Denmark, answers kindly furnished in the English language to some questions that I had submitted. I have put the information in its present form.

The aggregate extent of the state forests of Denmark is 142,140 acres, besides 2,962 acres for public parks. Of these, 67,700 acres are old forests, 74,440 acres are new plantations, especially on heathy tracts. The planting of forests had already commenced one hundred years ago, but has quite particularly increased since 1850. Forty-five per cent of the state forests are situated on the Danish islands; 54 per cent on the peninsula of Jutland, of which latter only 10.6 per cent are old forests, the rest are new heath plantations not yet thoroughly planted up. Beech comprises 37.7 per cent, oak 3.3, ash, maple, birch, elm and alder 4.8 per cent, and conifers 54.2 per cent. Conifers did not exist in Denmark 150 years ago, so that the extensive area of conifers in the state forests at present has been produced artificially. For the planting up of heaths the mountain pine (*pinus montana*) and the spruce (*picea excelsa*) are particularly utilized. The annual aggregate expense of administration averaged $40,000 per year for the period 1893–97. Annual aggregate revenue averaged per year for the period 1893–97: revenue $258,416, expenses $195,370. The smallness of the net revenue arises partly from the fact that about half of the state forests are still so young as to yield only a small revenue, partly from extensive new areas being cultivated every year. The area annually sown or planted to forest averaged 2,285 acres per year for the period 1897–1900. Regeneration from self-sown seed is only used in the case of the beech (*fagus silvatica*) and of the silver fir (*abies pectinata*). In all other cases, forests are regenerated by means of planting plants or sowing seeds.

There is a sustained yield. Every tenth year a working plan is prepared for cuttings and cultivations of the next decennium. In working out these plans it is taken

into consideration, as far as may be, that there should be such areas and stocks of wood in store for the future as are available for the decennium. Within such a decennial period the yield of the cuttings varies according to circumstances; as a rule, however, there is but little differing one from the other. The extent of the state forests being on the increase, the proceeds will naturally increase. The forests are divided into parts of 10—100 acres in size, according to the nature of the soil or the species and age of the stock of wood. Within each decennial period a certain number of such divisions are destined for cutting, and the latter is commonly to be finished and the areas restocked with plants at the end of the period.

Private persons are prohibited by the law of September 27, 1805, from cutting away those remnants of the old forests of the country still existing in the said year. In cases of offence, means are placed in the hands of the government to force the owners to restock the cleared area under control of the state officer in charge. Consequently but very few forest areas have disappeared in the course of the nineteenth century. The many new plantations in Jutland which have risen by means of government subventions disbursed through the "Hedeselskabet," are subject to the same prohibition of clearing. Finally, under the guidance of a board of administration not appertaining to the state forestry service, the government has caused the waste sandy downs on the west coast of Jutland to be planted in order to subdue the sand drift in those parts, which had in former times caused great devastation. At the close of 1899 about 27,000 acres of sand downs had been planted with a good result. Damages by forest fires occur every year, but they have hitherto been rather insignificant. On account of the dense population of the country the casual forest fires are quickly quenched. The principal cause of such fires is care-

lessness of various kinds. It is notorious that several forest fires have been caused by sparks from locomotives, but no number can be stated.

The administration of the state forests is under the Department of Agriculture; its yearly budget is voted under the general budget of finances and its officers are appointed by the king. The state forestry is managed by three forest masters, twenty-three superior foresters, sixty-nine foresters and 306 keepers. The superior foresters have the use of a house free of charge, together with a lot of arable land (30–100 acres) upon which they pay the ordinary taxes, besides a salary of $950–$1,250. The salary of the forest masters is $1,450, to which is added an allowance for traveling and other lawful expenses. The three forest masters give in an annual report on the operations of the local ranges under their supervision. Three reports are prepared in the department and printed in a condensed form as a supplement to the public accounts. Every tenth year is issued a review of the state forestry in the past decennium. The "Tidskrift Skovvasen" (forestry periodical), published in Copenhagen by Mr. C. V. Prytz, professor of forestry in the Royal Agricultural and Forestry Academy, and "Hedeselskabets Tidskrift" (periodical of the society for the cultivation of heaths), published by "Det danske Hedeselskab" at Aarhus, are the periodicals. The revision of the decennial working plans for state forestry, which is simultaneous with the preparation of the working plan for the next ten years, is undertaken by a "Skovtaxator" (appraiser of forests), classed directly under the department, and four assistant clerks. A second "Skovtaxator" with one clerk is constantly occupied in the experimental line, in examinations of the growth of trees and the economy of divers modes of forest husbanding, altogether in support of practical forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 505,900 acres, of which, by the statistics of 1896, beech (*fagus silvatica*) comprises 44 per cent; oak, ash, maple, birch and alder comprise 18 per cent, and spruce (*picea excelsa*), pine (*pinus sylvestris* and *montana*), silver fir (*abies pectinata*), larch (*larix Europea*), etc., 38 per cent. Three-fourths to four-fifths of these forests are managed on forestry principles. The extent of private forests by the official statistics was, in 1888, 414,837 acres, and, in 1896, 454,874 acres. By the law of September 27, 1805, before mentioned, and which is still in force, private persons are prohibited from cutting their parts of the old forests of the country standing at that time, aggregating at that date an area of about 280,000 acres. This area comprises (besides the old forest area of the state, about 100,000 acres) the remnants of the original forests of the country still existing. Since 1850 very considerable areas have been planted with forests, both by the state and by private persons, especially in the heathy tracts of the peninsula of Jutland. In these tracts an area of 108,500 acres has, since 1868, been planted by private persons, however under the guidance and control of the "Hedeslskabet" (society for the cultivation of heaths), which is aided by the state (for the year 1900 to the extent of $73,000); and of the above area 54,600 acres were thoroughly cultivated at the close of 1898.

FRANCE.

The total extent of the forests of France (exclusive of the colonies) is about 23,500,000 acres, which represents about 17 per cent of the surface of the entire territory.

These forests are divided in: Forests of the state, 2,700,000 acres; forests of the municipalties and of the public

institutions, 4,700,000 acres; forests of individuals, 16,100,000 acres. The forests of the state and those of the municipalties and of the public institutions are managed and supervised by the Administration of Forests. France only extends over 9 degrees in latitude, but, as it has very high chains of mountains, the result is that it possesses all the climates of Europe, from the hottest to the coldest, and that a great variety exists in the species of trees that compose the forests.

The principal varieties of these species are: In the warm region, comprising the borders of the Mediterranean sea and of the Gulf of Gascony, the cork oak (*quercus suber*), the evergreen oak (*quercus ilex*), the cluster pine (*pinus pinaster*) and the Aleppo pine (*pinus halepensis*).

In the temperate region, comprising the plains, the rolling grounds and the lower parts of the mountains, the common European oak (*quercus ruber*), the European white oak (*quercus pedunculata*), the beech (*fagus silvatica*), the hornbeam (*carpinus betulus*), the common European ash (*fraxinus excelsior*).

In the cold region, comprising the middle and upper parts of the mountains, up to the extreme limit of vegetation, the silver fir (*abies pectinata*), the Norway spruce fir (*abies excelsa*), the beech (*fagus silvatica*), the Scotch pine (*pinus sylvestris*), the mountain pine (*pinus montana*), the larch (*larix Europea*).

STATE FORESTS.

The total area of the forests of the state, 2,700,000 acres, is composed of 2,100,000 acres of productive forests and of 600,000 acres of protective forests, situated in the mountains or on the dunes of the ocean; of lands recently purchased by the state on the banks of torrents and whereon timber is now being planted.

The forests yield annually to the state:

Timber (cubic feet)	33,800,000
Fire wood (cubic feet)	62,300,000
Total	96,100,000

This represents nearly an annual production of 46 cubic feet of wood per acre of productive forest. The state forests produce in addition thereto oak bark, which is used in the tanning of leather; cork, rosin and several other small products; also hunting rights are leased.

The gross annual income in money is $5,500,000, or $2.62 per acre of producing forest. In some forests this average is largely exceeded and it attains as high as $8 per acre.

The expenses are as follows, viz.:

Labor	$1,240,000
Forest instruction	35,000
Sundry works	360,000
Reforesting of mountains	700,000
Taxes paid to departments and municipalties	360,000
Sundry expenses	60,000
Total	$2,755,000

But of all these expenses a large share is applied either in administering the forests of the municipalities or in executing works of real public utility in the "protection forests," or in reforesting mountain lands (to prevent slides and the like). If we make these several deductions we find that the expenses incurred in the producing forests do not exceed $1,500,000 or 71 cents per acre. The net annual income of these forests is therefore $2.62 less 71 cents, equal to $1.91 per acre.

The state forests are carried on either as high forest or as coppice, and are managed under regulations made by the President of the Republic. Cuttings are made yearly. In forests rich in wood there is cut every year an amount equal to the increment or growth; in forests poor in wood

they cut less than the increment in order to gradually increase the forest. The endeavor is made also to increase the production of the timber wood by reducing that of the fire wood. The "high tree forests" are cut down at periods ranging from 120 to 150 years.

The work is directed in a way that will insure natural reforesting from the seeds that fall from the standing trees. Not only the trees that have attained the age determined by the rules are cut down, but also the dead ones and those which are dying, and those that prevent the growth of neighboring trees. In temperate climate the annual cutting of high trees is on a limited area; a large number of trees are cut down simultaneously. In very cold climates and where winds are to be feared, only a few trees are taken away at a time on the same point, and cutting is then done on a larger area.

The low forest, coppice and second growth are cut in rotations, ranging from 25 to 35 years. The reserved trees, which are very numerous, are cut on an average every 100 years, but some selected trees are allowed to attain and even pass 200 years.

The labor performed in the forests consists in the construction and maintainance of forest roads, water sawmills, houses for watchmen, replanting. Fortunately, owing to the system of culture now in use, artificial reforesting has but little importance in forests, properly speaking, but sowing and planting in the small open spaces, or on the points where a few more valuable species are to be introduced, or where the soil of the forest is better adapted to some varieties, there sowing and planting are more frequent. The average cost of such work is $10.00 per acre.

Very considerable reforesting is made on mountain lands, where the state plants trees to regulate the action of the waters and stop the ravages of torrents. For that purpose $700,000 are expended every year, the

largest part of which is used in the purchase of land, and the other part in dams to regulate the streams, and in plantations to settle and retain the soil. The state purchases yearly, on an average, 16,000 acres. The average cost of reforesting is $20 per acre, and $18 must be added thereto for work in improving the streams, building roads, etc. Planting is preferred to sowing on calcareous or chalky soil.

The administration of the forests forms part of the Department of Agriculture. It has charge not only of the direction and care of the forests of the state and of those belonging to municipal corporations and public institutions, but also the overseeing of the fishing in the rivers and creeks. At its head is a director, residing in Paris, who has under him: A central service composed of 3 administering general inspectors, 10 inspectors, 5 assistant inspectors and 17 clerks.

An exterior service composed of:

First—Personnel superior or of administration—32 forest keepers, 200 inspectors, 215 assistant inspectors, 250 general wardens.

Second—Personnel inferior or of surveillance—3,500 foremen and wardens, paid by the state; 3,700 foremen and wardens, paid by the municipal corporations and public institutions.

The annual salaries paid are as follows:

SUPERIOR OFFICIALS.

Director	$3,000
Administrators	1,800 to 2,600
Forest keepers	1,600 to 2,400
Inspectors	800 to 1,200
Assistant inspectors	600 to 800
General wardens	300 to 520

Exclusive of some additional allowances for traveling expenses.

White pine on the south shore of Cass Lake. Some of Minnesota's most charming scenery. Photographed, 1899, for the annual report of the Chief Fire Warden of Minnesota.

INFERIOR OFFICIALS.

Foremen and wardens paid by the state an average of .. $160.00
Foremen and wardens paid by the municipal corporations and public institutions 116.00

The foremen and wardens receive in addition thereto allowances of firewood, tillable land, pasture grounds, etc.

Those in the employment of the state have free rent in houses built in the forest, or in lieu thereof they receive as compensation a cash equivalent.

The superior officials are entitled to a retreat pension at the age of 60 years, and the inferior officials at the age of 55 years.

France has three forestry schools. One school of higher instruction at Nancy; one school of secondary instruction, and one school of primary instruction. The two latter schools are established in the department of Loiret, on the possessions of the administration at Barres.

FORESTS OF MUNICIPAL CORPORATIONS AND OF PUBLIC INSTITUTIONS.

The forests of municipal corporations and of public institutions comprise 4,700,000 acres. They are supervised by the Forest Service on the same conditions and according to the same principles as the state forests. They contain about 200,000 acres of forests for protection, and their producing area is thereby reduced to 4,500,000 acres. They produce annually, timber, 42,000,000 cubic feet; fire wood, 128,000,000 cubic feet, and together, 170,000,000 cubic feet. This represents nearly an annual production in wood of 38 cubic feet per acre of productive forest. The annual cash value of the product, including the bark, cork and rosin, is $6,400,000, or $1.42 gross income per acre. The net income is about $1.14 per acre. The forests belonging to the municipalities and public institutions are under regulations approved by the president of the republic. These regulations and those of the state

forests have been established with a view of insuring a continuous annual production and even of increasing that production in the forests where it is not yet sufficient.

PRIVATE FORESTS.

Private individuals are at liberty to manage their forests as they please. But they are prohibited from cutting and taking trees from forests which are necessary to maintain and regulate water flow, to protect lands against the encroachments of the sea and sands, to defend the territory, or which are necessary for the public health. The destruction of private forests has become rarer and rarer and the proprietors acknowledge now that on soils of poor quality the income from forests is greater than that from arable land. As a result the area of private forests, instead of decreasing, increases from year to year by reason of the timbering of lands on which agriculture pays but small profits.

The income from private forests in quantity and in money is not exactly known. It is, however, known that on the same area they pay less than the state forests. Private individuals in their anxiety to get returns are inclined to cut down the wood when it is too young, and in the forests where coppice wood is raised they do not leave a sufficient reserve, and oftentimes leave none at all. One can notice, however, that the principles of sylviculture are spreading more and more in the culture of private forests. The large forests are subjected to the same mode of management and are treated like the state or municipal forests. On the whole the annual production is regular and tends to become better in both quantity and quality.

FOREST FIRES.

In the temperate and in the cold regions of France (that is, in the larger portion of the territory) the fires are but few and cause slight damage. The long periods of

drought are not frequent, the numerous roads that run through the forests make very good lines of defense, and the villages that surround the massive wooded areas furnish at the first alarm devoted laborers. The railroad companies, being held responsible for damage by fire caused by flying sparks from their locomotives, take particular care, and in exposed places cut the grass and brush along their roadbeds.

The forestry code forbids, under penalty of $4 to $20, carrying or lighting matches in or within a distance of 200 metres from the forests.

In the forest camps of the state, municipal corporations or public institutions, it is forbidden to the workers to light fire outside of the buildings or shops, the location whereof is indicated by the forest service.

In the warm region the dangers from fires are greater. As a preventative against them more roads are built, trenches 20 to 50 metres wide and kept free from grass and brush are made around the forest, along railroad lines, on the dividing lines between forests belonging to several owners, and also from distance to distance in the large and dense forests belonging to the same proprietor. The use of fire in forest camps and in agricultural camps situated within 200 meters from the forests is forbidden during the months of June, July, August and September. A special watch is organized, and telegraphic lines penetrating the center of the forests admit of alarm of fire at its start and call for help. If the working force appears to be insufficient the military authority furnishes the deficiency and sends on the spot soldiers who act according to the directions of the forest service.

COLONIES.

France, fully convinced that the preservation of forests is in all lands of the highest importance, has organized a forest service in its possessions outside of Europe—in Al-

geria, Tunis, Madagascar, Indo-China, Reunion. In Algeria the organization is exactly similar to that of France, and calls for an annual expenditure for salaries and works of $600,000.

HESSE-DARMSTADT.

STATE FORESTS.

The state forests of the Grand Duchy of Hesse-Darmstadt occupy 165,000 acres, and are situated in the Rhine valley (on alluvial sand), in the Vogelsberg mountains (on basalt and red sandstone), and in the Odenwald mountains (on granite, syenite and red sandstone). The prevailing species are beech, occupying 40 per cent, Scotch pine, occupying 34 per cent, and oak, occupying 16 per cent of the area under forest; whilst the remaining 10 per cent consist of spruce, fir, larch, alder and birch forest. It is a noteworthy fact, proved from the writings of Cæsar, Tacitus and of early German authors, that there were no coniferous trees present in their time except yew. Pine was introduced only from the 15th century on. The average value per acre is about $100; but there are great differences according to quality of soil, transportation facilities and density of population. The annual aggregate expense of administration is $148,500; and the annual aggregate revenue is $561,000. There are planted annually to forest 750 acres, the planting extending over the entire surface of the ground. On 2,500 acres, according as "blanks" in natural regenerations are stocked, partial planting takes place. There are used on an average per annum: 110,000 pounds of seeds of broad leaved species; 4,000 pounds of seeds of coniferous species; 5,000,000 broad leaved seedlings; 5,000,000 coniferous seedlings. The annual expense for starting new generations of trees

aggregates $22,000. Beech is invariably raised from the seed dropping from mother trees evenly distributed. Scotch pine is planted when one year old, over 10,000 seedlings being used for each acre. Spruce and fir are planted when four years old, or seeds are sown in strips being about four feet apart. Oak is either planted as a seedling two feet to three feet high, or acorns are dibbed in, the method used depending on local conditions. All plants are raised in forest nurseries, kept under the care of local forest rangers. Comparatively large areas are covered with oak-coppice forest, which is copsed every 15 to 20 years, with a view of obtaining tanning bark. White pine and douglas fir have been introduced with splendid success. American red oak and hickory seem to answer the local conditions fairly well.

In certain densely populated sections, where soil fit for agriculture is scarce, field crops (potatoes and rye) are raised together with tree crops during the first three to five years following the cutting of mature trees. Rows of potatoes alternating with rows of pine seedlings are frequently seen. This combination reduces the expense of reforestation. It secures for the seedlings a soil of high porosity, whilst it exhausts, on the other hand, the mineral contents of the ground and the accumulated layer of humus.

Reforesting is effected on about 40 per cent of area by seed from standing trees; on about 10 per cent of area by coppicing and on about 50 per cent of area by artificial sowing and planting. The annual yield is strictly sustained. The yield per acre per annum is 74 cubic feet, of which not less than 60 cubic feet is used as fuel. The value of cordwood piled up along forest roads is about $2.50 per cord. The value of logs cut and hauled to forest roads is about $11.25 per 1,000 feet board measure. As to the usual method of cutting a crop, about 30 per cent of the yield is made up of stuff obtained from thin-

nings. The remaining 70 per cent consists of mature trees. Wherever regeneration is effected from self-sown seed, the mature trees are gradually removed. Where planting is resorted to, a clean sweep is made of all mature trees over areas aggregating about 25 acres on an average. Large clearings are considered a mistake, as it is difficult to restock them.

With regard to compulsory reforestation the following may be said: Private forests must be planted up within three years after the removal of a mature crop. Exemptions from this rule may be granted, upon application, by the State Forestry Bureau. Waste land planted up by the owner is, once for all, exempted. If a forest owner hesitates to replant his clearings within three years after the cutting of the trees, he is subject to a fine. The forest authorities will replant the clearing at the owners' expense, the owner being allowed the choice of species. Any treatment of forests likely to result in permanent unfitness for the production of timber, is prohibited.

Little damage is done, generally speaking, by forest fires. On the average annually 54 fires are reported, running over 45 acres altogether, and resulting in an annual loss of $533. In 28 cases out of 272 cases the forests were so badly damaged that it was considered wise to cut the trees and replant the area thus cleared. The principal cause of forest fires is carelessness of smokers. A few only of such fires are annually caused by railroad locomotives, perhaps three annually.

The rank of the forest officer corresponds entirely with the rank of officials in other branches of the public service. The average salary per year of the "Oberforstrat" is $1,300, of the "Oberforstmeister" $1,125, of the "Oberforster" $825, and the office and transportation expenses of the last two named are $350 and $200 respectively. No official report is published, either annually or periodically.

PRIVATE FORESTS.

The extent of private forests is as follows: Communal forests, administered by state foresters, 235,000 acres; entailed forests, owned by families, 132,000 acres; ordinary private forests, owned by individuals, 70,000 acres; total, 437,000. All communal forests and all entailed forests are managed on forestry principles, furnishing a sustained yield. The condition of the ordinary private forests is deteriorating, as the productiveness of the soil is abused by pasture, removal of litter and incomplete density of leaf canopy. Communal and entailed forests are worth as much as state forests, namely, about $100 per acre. The value of private forests owned by individuals is considerably less. The average rate of net income is about 2½ per cent. The total product of the country is well sustained.

Considerable sums are derived in state and communal forests from hunting and fishing leases. The foresters of all grades enforce, *ex-officio*, all fish and game laws. The subaltern foresters, as a general rule, are taken from the army.

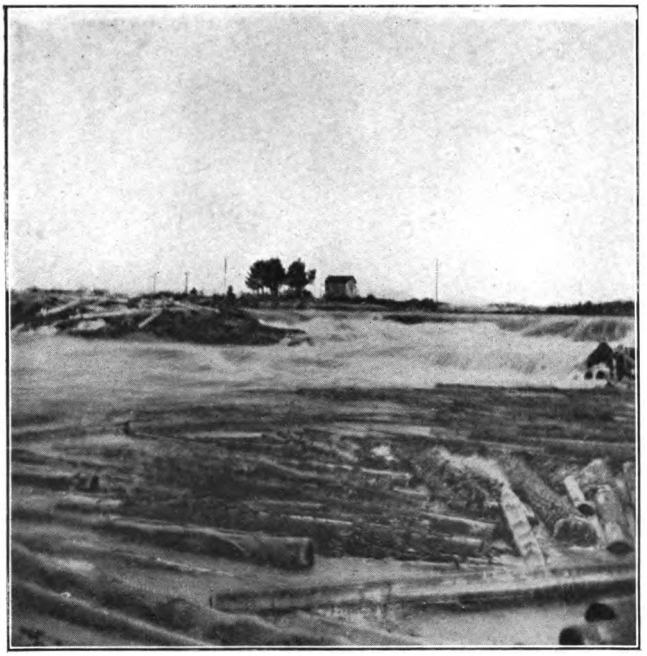
The wages of the common laborer average about 50 cents per day. In the mountainous sections wood fuel is cheaper than coal. In the state forests $24,700 are annually spent for new roads, or for macadamizing old roads. The state oberforster is at the same time the manager of all municipal or village forests lying within his district. The sale of forest produce, however, is done by the mayors of towns and villages. A splendid system of well graded public roads, covered with stone in the Tellford system and maintained at an annual expense of $270 per mile, facilitates economic forestry to a very high degree.

ITALY.

STATE FORESTS.

It was a peculiar pleasure to receive, as I lately did, from the Ministry of Agriculture at Rome, an account of the forestry of Italy, that beautiful country which dates back thousands of years and whose woods have been sung by Horace and Virgil. The aggregate area of the state forests is 128,960 acres, principally situated in Tuscany—provinces of Florence, Orezzo, Grosseto, Pisa and Leghorn; and Venice—provinces of Belluno, Treviso and Udine. These lands are regarded as inalienable. The prevailing kinds of trees are oak, beech, pine, larch and fir. The total annual expense of administration averages about $80,000. The annual sale of the raw material from the state forests averages $150,000. The number of acres annually reforested with trees is 150. The method of reforesting varies according to the different species of trees and the local conditions; but seeding, whether artificially or naturally, is used only for the oak and the beech. For other kinds, such as the fir, pine, larch and chestnut, reforesting is done by planting. Generally good care is taken to maintain a sustained yield. In regard to cutting, the practice is to cut only those trees which have reached fiscal maturity and those that are dead or about to die.

The damage caused by forest fires amounts to about $80,000 a year. The causes are principally accidental. Only a very small number of forest fires are caused by railway locomotives. The forest service has much importance in the protection of mountainous land and in the control of water. The annual salary of the chief inspector of the forests of the first class is 6,000 lire; that of the chief inspector of forests of the second class, 5,000 lire; that of inspector of forests of first class, 4,000 lire.



Rainy Lake Falls, showing glimpse of the village of International Falls formerly called Koochiching. Photographed September, 1903, for the annual report of the Chief Fire Warden of Minnesota.

Hard wood forest between Bena and Leech Lake River allotted to the Chippewa Indians. Photographed for the Chief Fire Warden's annual report August, 1903.

The Minister of Agriculture generally publishes a detailed report on the administration of the forests every five or six years.

NORWAY.

STATE FORESTS.

The extent of the state and semi-public forests of Norway is 2,587,500 acres. Of these, 837,500 acres are located in the provinces of Tromso and Finmark; 140,000 in that of Norrland; 285,000 in North Drontheim, and 225,000 acres in South Drontheim and Romsdal, and about 397,500 acres in Hedemarken. The prevailing kind of trees are pine (*pinus sylvestris L.*), spruce (*Abies excelsa D. C.*), and two species of birch. The average estimated value of the forest land is $2.70 an acre. The annual aggregate expense of administration is about $108,000, and the annual aggregate revenue varies from $60,000 to $67,500. The number of acres annually sown or planted to forest varies from 150 to 175 acres. Reforesting is almost entirely effected by natural seeding from standing trees, and, when artificial culture is employed, by planting trees. The crop of forest production is periodical, and depends partly on the market prices of lumber. The forest administration tries to prevent the yearly average yield exceeding the net increase of the forest. Cutting must in part depend on the demand. Where it does not pay to cut smaller trees, the mature ones are principally cut, while at the same time, as far as possible, diseased and injured trees, as well as such as would hinder in the growth, are removed. Where, on the other hand, trees of smaller size can be profitably sold, small blocks are cut clean in order better to promote new growth.

The law of July 20, 1893, on the preservation of "Protecting Forests" and against the destruction of forests, has special provisions relating to "Protecting Forests," by which are meant forests serving as a protection against snow avalanches, stone slips, alteration of river beds, shifting sand, or as a special protection to other forests or to inhabited country. "Protecting Forests" are also such as bound districts and mountain forests, which, from their situation on the slopes of high mountains or in the neighborhood of the sea, or in the far north, grow so slow that they would die out if neglected. Under "Protecting Forest Lands" are also included bare fields, to be planted in the future to serve as other "protecting forests." The municipal council selects three men, who, after consulting the public forest officer, propose the localities within the district to be considered as "protecting forests." The municipal council has then to fix the boundaries of the forests, and on the proposition of the forest inspector of the district to determine the rules for its management. These regulations must have the sanction of the king to be valid. The municipal council can also make reservations, subject to the king's approval, against the destruction of the forests in general. Such municipal regulations relating to "protecting forests" and forests in general may probably also include compulsory regulations as to planting and sowing of forests already cut down. No other laws relating to forest culture exist in Norway.

The damage caused by fires in the public forests is inconsiderable. Many years there is none; and the damage done to private forests is of small account and unreported. The principal cause or causes of such fires is carelessness of owners, fishermen, cowherds, etc., as well as the burning of heather for cultivation of the land. The law of July 14, 1893, on "Fires in Forest and Fields," with the supplemental law of July 27, 1896, has provisions relating to the prevention and extinction of forest fires.

The central administration of the forests is directly under the department of the interior, without intermediate officers. The service is under the charge of the chief (the director of the forests), and there are 4 forest inspectors, 25 forest officers, 1 forest engineer, 2 assistants, 7 forest planters and 363 forest guards. The yearly salary of the chief (the director) is $1,450, without additions. The inspector's salary is $800, increasing up to $970. The forest officers, $480, increasing to $800. All these functionaries have their traveling expenses paid when traveling in the service of the state. The officers and the inspectors hand in every year a report to the director, who publishes a report on forest matters generally every third year. The only forest periodical in Norway at present is the "Tidsskrift for Skovbrug," (Periodical for Forestry), published by the Norwegian Association for Forestry.

PRIVATE FORESTS.

The aggregate extent of private forests is 18,000,000 acres, of which about 276,000 acres are managed on forestry principles. The average value per acre is from $4.28 to $5.36, and the average annual rate of net income is from 55 to 60 cents per acre. The cutting undoubtedly exceeds the natural increase of the forests. The supply of wood is consequently decreasing, and the size of the trees decreases. The government purchases annually forests to the amount in value of $21,440. It has three large and several smaller nurseries. These supply the required number of plants to the public and to private parties. It has also four seed establishments, which supply the public and private demand for tree seeds. It also has two elementary schools of forestry, and it tries through its functionaries to instruct forest owners in rational management of the forests.

PRUSSIA.

STATE FORESTS.

The extent of the state forests of Prussia is 6,955,227 acres. Included in this, however, are 715,637 acres not designed for tree culture. In addition, the extent of forests belonging to municipalities is 2,563,812 acres; belonging to churches, 207,752 acres; belonging to corporations, 555,900 acres; private forests, 10,828,730 acres; making an aggregate extent of 21,111,421 acres in the whole kingdom.

The prevailing kinds of trees in the state forests are Scotch pine, larch, beech, red pine, fir and oak. The value of the land varies so much, rising from a small amount to $700 per acre, that it is impossible to give an average estimated value. The annual aggregate expense of administration (state forests) is as follows: The office expenses and maintenance, including expense for education in forestry, etc., averaged in the years 1893 to 1897, per annum, $8,500,000. The annual aggregate revenue in the years 1893 to 1897 amounted to $17,200,000, being at the net rate of $1.50 per acre of actual forest. The number of acres sown or planted with forest annually during the years 1893 to 1895 was 44,830.

The foresting of the beech is mostly effected from standing trees, though artificial sowing and planting are also done. The oak is either reforested by seed from standing trees, or artificially through sowing or by planting. The Scotch pine is first cut clean and reforested by sowing or planting, and the red pine the same. Sowing from standing trees is not common. In regard to the continuity of forests products, the forestry department endeavors to obtain the highest possible continuous net income. The usual method of cutting is in blocks clean.

Under the head of compulsory tree planting the following laws are referred to: The Forest Protection Law of

July 6th, 1875; the law of August 4th, 1876, concerning the administration of forests owned by municipalities and public institutions in the provinces of Prussia, Brandenburg, Pomerania, Posen, Silesia and Saxony.

The average annual damage caused by forest fires in the years 1892 to 1896 was as follows: Totally or mostly destroyed, 2,992 acres; only slightly damaged, 117 acres; only the surface destroyed, 522 acres. The average annual number of forest fires in the years 1892 to 1896 was 36, the causes of which were as follows: 12 unknown, 2 railroads, 5 incendiary, 16 caused by carelessness, 1 lightning. During the years 1892 to 1896 the annual average number of forest fires caused by railroad locomotives was 2.

The officers in the forest service are equal in rank to the other high grade officers in the government service. The foresters have clerical rank. The salary of "Oberforster" (district manager) ranges according to length of service from 2,700 to 5,700 marks. Unfavorably situated officers receive an additional amount, the maximum of which is 600 marks annually. In addition there is usually free residence and fuel. The salary of the "Oberforstmeister" (chief inspector) is from 4,200 to 7,200 marks, according to length of service, which is calculated from the time of qualification for the office of "Forstrath" (councillor). The "Oberforstmeister" and "Forstrath" are each allowed an amount not exceeding 2,900 marks for traveling expenses.

PRIVATE FORESTS.

The extent of private forests in Prussia, as above stated, is 10,828,780 acres. About one-half of these forests are managed on forestry principles, and their average value is somewhat less per acre than that of the state forest. On the larger estates the area devoted to forests gradually

increases, while on the smaller estates the forest area probably decreases.

Some of the forests of Prussia are attractive resorts for travelers, and especially pedestrians, who enjoy the excellent roads. Of the celebrated Thuringian chain, which is 70 miles in length by from 8 to 25 miles in breadth, a writer says: "The successive hills melt into each other in gentle undulations, forming a continuous and easily traced comb, and only the northwest slopes are precipitous, and seamed with winding gorges. This mountain range incloses many charming and romantic valleys and glens; the most prominent feature of its picturesque scenery is formed by the fine forests, chiefly of pines and firs, which clothe most of the hills."

Prussia comprises nearly two-thirds of the entire extent of the German Empire, yet its area lacks considerable of being twice that of Minnesota. Thirty-one per cent of its soil is predominantly sandy, and on the whole probably is not as good as that of Minnesota; yet it sustains a population twenty-five times as large as that of Minnesota. This fact might well find a lodgment in the minds of our statesmen, that whereas Prussia annually derives a net revenue of $1.33 an acre from her 6,000,000 acres of state forest, our state, from about an equal area of land in its borders, adapted to forest, derives no regular net revenue at all.

DUCHY OF SAX-MEININGEN.

The area of state forests is 106,530 acres; of communal forests, 84,460 acres; of private forests, 71,850 acres; miscellaneous, 1,480 acres; in the aggregate, 264,310 acres, being equal to 42.4 per cent of the total area of the state. The state forests comprise 24 units of ad-

ministration, in charge of 24 superior forest officers. The highest functionary in forestry matters is the president of the forestry bureau. The bureau is composed of five forest counsellors, two of whom act as forest inspectors at the same time, each one supervising 12 of the above named 24 forest officers. The annual yield of the state forests is 5,779,669 cubic feet of lumber and fire-wood cut in ripe forests, and 1,288,904 cubic feet of fire-wood and pulp-wood obtained from thinnings. These figures correspond with an annual yield of about 155 feet board measure of lumber plus 0.40 cords of fire-wood per acre per annum. The state forest officers at the same time control the management of the communal and private forests within the state. All grades of forest officers have certain police duties concerning forests, fish and game preservation.

The municipalities owning forests are required to appoint well trained foresters for the management of their forest realties.

SAXONY.

STATE FOREST.

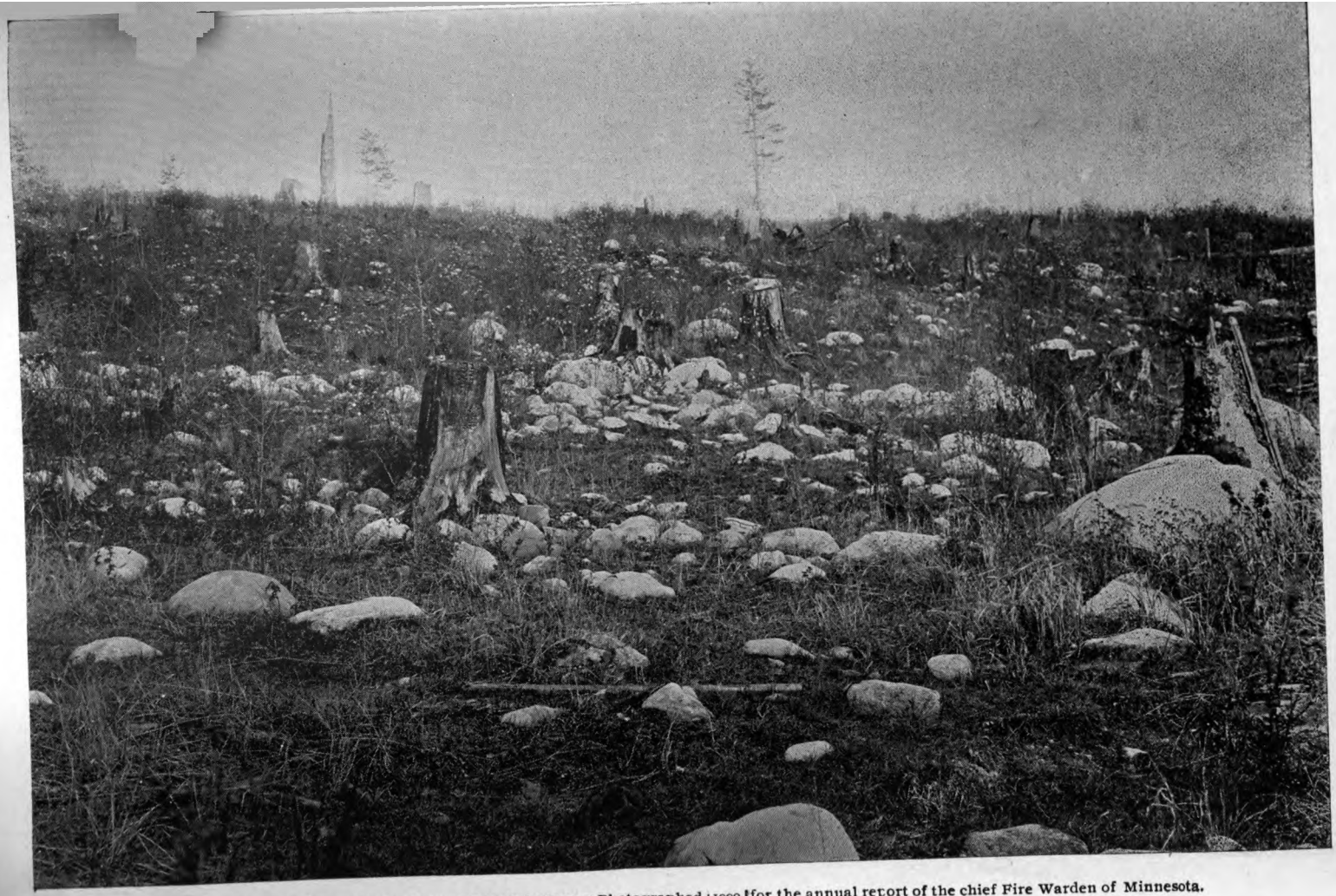
The aggregate area of the state forest is 432,000 acres. The forests are scattered over the Erz mountains themselves and over their outskirts. They are further situated in a few smaller and separate mountain ranges and in the plains. The altitude at which the state forests are found ranges from 100 to 1,200 meters, or from 328.1 feet to 3,937.2 feet, above sea level. The first group of forests, in the Erz mountains, is pretty compact and comprises 200,000 acres. The second group, in the outskirts of the Erz mountains and in some smaller distinct mountain ranges, comprises 136,000 acres; and the third group, in

the plains, comprises 96,000 acres. The soil consists of decomposed granite, granulite, gneis, mica-slate, clay-slate, grauwacke, porphyry, sandstone and some basalt. In the plains there is diluvium and alluvium. Only a very small portion of the forest area might be deemed fit for agricultural use.

The principal tree species are spruce, picea excelsa (Link); Scotch pine, pinus silvestris (L.); silver fir, abies pectinata (D. C.); larch, larix europaæ (D. C.); roth-buche, fagus silvatica (L); oaks, quercus pedunculata (Ehrh.), and qu. sessiliflora (Sm.); hornbeam, carpinus betulus (L.); ash, fraxinus (L.); several maples, namely: acer pseudoplatanus (L), A. platanoides (L); further, several species of elm, ulmus; of birch, betula; and of linden, tilia. The prevailing species is spruce.

The value of the state forests, including timber and soil, aggregates $76,490,000. Hence the value per acre is $177. The annual expenses for administration for the year 1896 were $1,040,000. In the year 1896 the annual gross revenue amounted to $2,986,000; the annual net revenue to $1,946,000.

The entire area planted annually varies according to circumstances. On the average it will reach 6,900 acres. Of these 6,900 acres 800 acres are planted up with seeds and 6,100 acres are planted up with plants. About 20 per cent of the above figure 6,900, or 1,380 acres, consist of blanks in plantations previously made where the original planting has failed. Thus it appears that the area planted for the first time after the removal of the old crop is only 5,520 acres. The question whether plants or seeds shall be employed for restocking cleared ground depends on the condition of the soil. As a general rule, seeds are planted only on such areas which do not produce grass and weeds to a large extent and which at the same time are of sufficient fertility and well protected against late frost. The sowing or planting of seeds must



Cut over, non-agricultural pine land, near Mountain Iron. □ Photographed, 1900, for the annual report of the chief Fire Warden of Minnesota.

be done not later than in the second year after the final removal of the former tree crop. Strips about three feet wide or places about six feet square are cultivated with a spade before the seed is thrown on them. Only in rare cases the entire area to be planted with seeds is ploughed and harrowed and the seeds spread over it broadcast. The plants used for planting up a clearing are as a rule two years old or older. The age of the plants selected depends on the condition of the area to be planted aside from depending on the species itself. Spruce, Scotch pine, fir and larch or tamarack, as a general rule, are used two to five years old; beech, oak, ash and maple, as a general rule, are used three to six years old. The plants are raised in nurseries. Only in rare cases they are taken from areas previously planted with seed in the open forest. The number of plants used per acre ranges between 600 and 4,000, according to the species, the size of the plants used and the condition of the area to be planted.

Regeneration from self-sown seed is only used in the case of the beech (*Fagus silvatica*). In all other cases forests are regenerated by means of planting plants or sowing seeds.

There is no law or rule in Saxony for compulsory reforestation after clearings.

There is not much damage done by forest fires. It averages $300 per year. Forest fires of a larger extent have happened very rarely. As a rule, forest fires are caused by the careless use of matches by tobacco and cigar smokers. Very few fires are caused by sparks from locomotives; on the average perhaps three per year.

The yield or annual cut is fixed by working plans prepared for periods of ten years and renewed after the lapse of such periods. Within these periods the annual yield is almost constant. At the end of a period, however, a new working plan might provide for either a higher or

lesser yield. It is an iron-clad rule that on the whole the cut shall not exceed the increment of the forest.

Trees are cut as low down as possible above the surface of the soil; the instrument used is the saw. The stump and the root are dug out afterwards wherever such work is remunerative, viz., where the wood obtained can be sold at a paying rate. In Saxony regular forest management began with the beginning of the century in a systematic way; consequently the forests now existing are almost even aged and composed of trees of almost even size; hence there is no objection to clearing an entire area of given size, say of two or three acres, at once, removing from it every tree standing on it. In exceptional cases, pieces of forest not entirely mature may be sacrificed with a view of saving others from the dangers threatening from storms and insects.

The average age of maturity in Saxony for conifers (spruce) is eighty to ninety years. However, there are cases in which this rule is not adhered to. The size of trees when fit for the axe depends entirely on the species, on the condition of the locality, the means of transportation, etc. Previous to the final cutting, and beginning with the twenty-fifth year of a piece of forest, and ending at the sixtieth year of the forest, thinnings take place at intervals of about ten years with a view to allow increased light and increased space to the most promising specimens of the growing stock. Specimens growing less vigorously, dying or dead, are removed at the same time wherever it pays.

There is no difference in the rank of the forest officer compared to that of any other state officers employed in the technical branches of the government. The state forestry service is divided into a lower and higher branch. The professional training for the first one is a merely practical training, whilst the latter necessitates scientific preparation of a high class. The requirements with reference

to this scientific preparation are as follows: Graduating from a state gymnasium; six months of practical instruction under a forest officer on one of the state forest ranges; twelve months' study at a university; two and a half years' study at the forest academy at Tharandt, at which two examinations must be passed; three years of practical professional training under a forest officer and at the bureau of forest working plans at Dresden; examination by the state authorities. After this preparation, as soon as there is a vacancy, appointment as government officer might follow, to begin with as assistant of an Oberförster (Superior Forester); then as superior forester, and so on up to the higher ranks of chief of a forest territory or chief of the bureau of forest working plans. The latter officers have the title of "Superior Forest Master." The highest technical authority controlling the local and territorial officers is called "State Forest Master." There are 108 local ranges in Saxony allotted to 11 territorial districts. The former are in charge of a superior forester (Oberförster), the latter in charge of a superior forest master. The central bureau of the entire state forestry service is under the Secretary of Finances.

The salary of a superior forest officer averages $1,015 (from $1,150 to $1,180), to which must be added an allowance of $566 for traveling expenses, horse keeping and the use of a house free of rental. The salary of the Superior forest master averages $1,486, ranging from $1,274 to $1,698, to which must be added a traveling allowance of $708 and the use of a house free of charge.

In the case of physical disability the forest officers draw a pension depending on the duration of their state service and on the salary received so far. This pension is at least 30 per cent of the salary. In no case does it amount to over 80 per cent. The latter figure is paid after thirty-nine years or more of state forestry service. At the age

of sixty-five years the state forestry officer is entitled to a pension in case he desires to retire, even if his constitution would enable him to continue in the service.

No annual report of the Saxony forest administration is published.

"Das Tharandter Jahrbuch" is considered the best periodical on forestry.

As further information, it may be stated that the administration of a forest range, by the superior forester under the supervision of the superior forest master, is outlined by "the working plan" which is prepared by the bureau of forest working plans at Dresden, containing prescriptions for a period of ten years. The superior forest officer co-operates in the preparation of this working plan, which has to be submitted to the secretary of finances. The preparation of a working plan is based on a thorough knowledge and a thorough scrutinizing of the conditions of the forest range, which often takes several months. The forest working plan contains a statement showing the areas of the different compartments or units of the forest range; it contains a description of these compartments and maps of the same; all sections of the forests are examined with reference to their increment. All these investigations made, the forests or sections of forests to be cut during the next decade of years are selected and pointed out specifically. Further, there is stated specifically what compartments or sub-compartments are to be thinned out, what areas are to be planted up, and by what means regeneration is to be effected in each single case. Deviations from the prescriptions of a forest working plan must not be made unless authorized by the secretary of finances. Every working plan is controlled by the state forest master in the range itself. Besides, in the midst of the ten years period, or after the lapse of five years, such a control by the highest forest officer of the state takes place, so as to find out whether and in how

far the prescriptions of the working plan have been followed and whether deviations might be advisable.

The sale of the forest produce (timber, fuel, bark, stones, etc.) is done by the superior forest officer with the help of a local state cashier, who is holding an office absolutely independent from the forestry service and is directly subordinate to the secretary of finances. This arrangement makes embezzlements practically impossible. The sale of timber and fuel takes place, after they are cut and piled up, by means of public auction. The cutting and piling of timber and fuel is done by common hands working under a contract. Any planting, on the other hand, is done by day workers, under the supervision of the local rangers, so as to warrant careful work.

PRIVATE FORESTS.

According to a statement made for the year 1893, the total area of the private forests in Saxony is 539,000 acres. All forests owned by municipalities and villages and other corporations, and a considerable fraction of the larger private forests, are managed according to true forestry principles. All administrations of municipal, town and village forests are controlled by the state. The working plans for these forests are prepared by the bureau of forest working plans at Dresden. In these cases, the forest working plan is approved of by the secretary of the interior, and not by the secretary of finances, as would be the case for state forests.

It is impossible to give any data as to the average value per acre of communal and private forests. Neither are data available as to their average annual yield. Generally speaking, the yield of private and communal forests is considered to be lower than from state forests. Wherever there are working plans the cut is steady, and even during the period over which the working plan extends.

Where there are no working plans, the cut depends entirely on the pleasure of the owner.

Small holdings of forests, especially those of the peasantry, are deteriorating. Parts of such forests are changed into fields or meadows; other sections are purchased by the state, communities or wealthy private individuals.

GRAND DUCHY OF SAX-WEIMAR.

The area of state forests is 110,910 acres, of private forests 120,510 acres, in the aggregate 231,420 acres, being equal to 25.6 per cent of the total area of the state. The state forests comprise 37 units of administration, in charge of 37 superior forest officers, trained at the forest academy of Eisenach.

The control of the local forest administration is effected through six forest inspectors, the highest authority in forestry matters being represented by a forestry bureau, attached to the office of the secretary of finances. Forest working plans are prepared and their execution controlled by the "Commission of Forest Working Plans," at Eisenach, the director of the forest academy being at the same time chief of that commission. The annual yield of the state is 5,864,177 cubic feet of lumber and fire-wood, corresponding with about 125 feet board measure timber plus 0.31 cords fire-wood per acre per annum.

The main duties of the superior forest officers consist of: Care of the property; maintenance of boundary lines; preventing the acquisition of prescriptive rights to pasture, litter wood, etc., by outsiders, and preventing forest offenses; maintainance of the growing stock of timber; forest utilization and forest regeneration, as prescribed by the working plans; sale of forest produce and control of the book-keeping.

SWEDEN.

STATE FORESTS.

The aggregate extent of the state forests of Sweden in 1895 was 18,080,753 acres. The area of state forests is annually increasing by extensive purchases of private forest. The prevailing kinds of trees are spruce (fir), pine and birch. The estimated value of the state forests is $4 per acre. The figures in this statement are for the year 1895, in which the aggregate expense of forest administration was $185,397, and the aggregate revenue was $1,126,636. The number of acres sown or planted to forest was 10,875. The number of acres damaged by fire was 1,200, and the amount of damage was about $10,000. Neglected camp fires and carelessness when burning fields for cultivation are the principal causes. Only three fires were caused by railroad locomotives. The state forests are divided into 9 districts and 74 ranges ("revir"). The chief of a district is an officer entitled "Öfverjägmästare," with annual salary of $1,707 and rank corresponding to the rank of major in the army; the chief of a range ("revir") is an officer entitled "Jägmästare," with a salary of $1,200 and rank corresponding to that of captain in the army. Before any one can be appointed as "Jägmästare" he must have passed successfully the examinations required after a year's attendance at one of the forest schools, the examinations required during a two years' course at the College of Forestry at Stockholm, and must have practiced forestry a year on a range. Foresters or guards receive a salary of $160. The state provides dwellings in the vicinity of the forests for officers and foresters. At the head of the forest administration is a director general, with salary of $2,400, and having rank corresponding to that of a major general in the army;

and a chief of bureau, with salary of $1,867 and rank corresponding to that of a lieutenant colonel in the army.

There is a continuity of forest product based upon certain plans of cultivation. Reforesting is effected partly by sowing, partly by planting, but principally by seeds from standing trees, assisted by planting. The usual method of harvesting the forest crop is, in the southern part of the country, by cutting in blocks clean; in other parts of the country by cutting trees only down to a certain size fixed by law. The total forest product of the country is sustained, and it is increasing.

PRIVATE FORESTS.

The aggregate extent of private forests is 58,715,135 acres and their average value per acre is estimated at about $5. About twenty-five per cent of private forests is managed on forestry principles. A royal committee is preparing a project of forest laws to promote re-growth of private forests.

FORESTS OF THE UDDEHOLM COMPANY, SWEDEN.*

The forests of the Uddeholm Stock Company are situated in nine parishes in the province of Vermland and in two parishes of the province of Dalarne. Karlstad, on Lake Wenern, about fifty (English) miles distant, and Gothenberg, about one hundred and eighty miles distant, are the nearest export harbors. Lake Wenern is connected with the Baltic and also the North Sea by the Gotha and Trollhatte (canals). The company owns fifty-six miles of railroad—Nordmark-Klarelfven—with thirteen stations, which transports all sorts of goods, especially iron and lumber, to and between the works. The company owns 400,000 acres of land in Vermland and 25,000

*Information furnished in Swedish by Dr. Fredrik Loven, chief forest master, through Mr. Gust. Jansson, manager of the Munkfors Iron Works.

acres in Dalarne. About 60,000 acres have been acquired within the last ten years. Of the entire area, not exceeding 60,000 acres consist of naked tracts, fields, meadow, also unproductive surface of moss, lake and rocky elevations; while at least about 375,000 acres consist of natural forest-bearing land. Hereof perhaps 15,000 to 18,000 acres are pasture land. Pine comprises 70 per cent of the forest, and spruce 30 per cent of all trees large enough for the saw. The birch is the prevailing species within the pasture, but among the birch conifers are generally found.

The Uddeholm Company's lands lie on both sides of the Klar river along its middle course. The parish of Rämen, in Vermland, and the boundary of Dalarne terminate the extent of the property on the east and the two judicial districts of Fryksdal on the west. About 375,000 acres lie in one body. Only a very little public forest and some belonging to farmers are included therein here and there. The rocky elevations consist of primary rocks, principally granite and gneiss, with interspersed hills of hyperite. West of the Klar river red iron gneiss is almost the prevailing rock, but east of the same river granite prevails, in large part solid, not crystalline, but there are large tracts of primary granite poor in feldspar. On granite, pine prevails to the extent of 75 to 80 per cent, while on gneiss spruce occupies at least 40 per cent of the surface. On the "hyperite" hills spruce of large growth prevails. The soil in the forest is composed partly of the disintegrated rock such as above mentioned and partly of deposits of older or later water courses. Much of the soil is gravelly; much also is sandy. The Klar river within the region of the Uddeholm forest is 400 feet above the sea, and on the east and west sides rise very steep hills which at a distance, generally of a thousand yards, attain a height of from 1,000 to 1,500

feet above the sea; thereafter they take a plateau form, but are very often broken by water courses or bogs. The whole region is thereby in a large degree of that cut or broken character which one can readily obtain an illustration of by ascending one of the principal heights. The highest and only actually barren-topped mountain in the company's forest is Harfjellet, 2,200 feet above the sea. Another, Tönnet mountain, 1,700 feet above the sea, is called a "fjell" (barren-topped or snow-covered mountain), but it is not actually that, for it is partly forest-covered.

Agriculture takes a subordinate place; the land most suitable for cultivation is generally along the banks of the larger streams. About 700 persons occupy small farms as tenants and are obliged to produce certain quantities of charcoal, in general 6,600 bushels each, and in all 4,620,000 bushels. They are also obliged to transport the coal to the works. Besides, there are several hundred forest laborers with smaller premises on which one of two cows and several smaller animals are fed. About 14,000 persons live and gain their livelihood on the company's property.

About 3,000 acres (2,700 to 3,000 "tunnland"; one tunnland being equal to 1.22 acres) are consumed or cut over annually; though it is not easy to say just how much, because clean cutting and selection cutting (cutting only the larger trees) are both practiced. On an average every tunnland (1.22 acres) ought at the end of every rotation period—120 years for pine and 90 years for spruce—yield from 4,000 to 4,500 cubic feet of lumber.

The forest is handled by means of cutting trees that hinder the growth of others or which are themselves defective ("hjelp och rensningsgallringar"), and thinning to admit light ("ljushuggningar"), consisting of two to three careful timber cuttings with an interval of 15 to 20 years,

Rapids in Isabella River, Lake Superior Forest Reserve, July 11, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota,

which end either by leaving seed trees or in clean cutting. The best stands of pine are finally cut at the age of from 130 to 140 years, and the middling at the age of 120 years, and the poorer at the age of 100 years. The spruce stands in which thinning is much practiced are nevertheless very sensitive to damage from excess of light, wherefore timber cutting must be undertaken with great care and skill, otherwise drought occurs. Spruce is cut at the age of 70 to 100 years, according to its quality. During the past ten years there has been cut yearly 12,000,000 cubic feet of lumber of various sorts, namely, of saw and building timber, 2,000,000 cubic feet; spruce for paper pulp, 850,000 cubic feet; telephone and telegraph poles, 125,000 cubic feet; firewood, 2,275,000 cubic feet; wood for charcoal, 6,600,000 cubic feet; miscellaneous, 150,000 cubic feet. Besides, there was each year brought to the works and consumed stub-wood to the amount of 1,500,000 cubic feet.

Certainly not more than 15, or at the highest 20, per cent of the cut-over area becomes restocked by natural seeding. The cuttings are not so large but what the by-standing trees can in an essential degree contribute to renewal, and, besides, very often 15 to 20 seed trees are left on each 1.22 acre tract. The difficulties which forest culture meets with in this locality are very stony land, spring and summer drought, spring frost, sometimes, as during the previous year, excessive rain, mossy or swampy land and land heavily pastured by cows and sheep. On the other hand, the forest area is not much troubled with heath, strong growth of grass, insects, etc. In regard to sowing, the twigs are burned immediately after the frost is out of the ground, and while the ground is damp. Generally the following year the cleared area is sown with pine and spruce seed. On pine land spruce seed is mixed to about 50 per cent. On land which is suitable

for both, 60 to 70 per cent of spruce seed is used. On pure spruce land 15 to 20 per cent of pine seed is mixed in. On cleared land, to prevent injury from drought, long, narrow seed strips — made by hatchets — are used about a yard apart, not large squares; but when heath or grass growth is to be feared then planting is to be preferred. For hacking of these seed strips are selected places which are suitable for the growth of the seeds and protection of the plants, such as the north side of shading objects,—for example, stumps, windfalls, fixed rocks, etc. The seed is laid on the south corner of the seed strip so that seed and plant will be better shaded. When sown on rocky land it has to be raked and covered by hand. On even ground the seed strips should be made in a direction from east to west, and the seeds not deep, harrowed down along the south border of the strips. On the other hand, on steep descents the seed strips should be laid horizontally, so that the seed, in case of heavy rain, shall not be washed down the hill. During the latest ten years there have been yearly about 2,400 acres sown with from 800 to 900 kilograms of conifer tree seed.

The planting of forest trees takes place on the company's land on a small scale and only where strong growth of grass hinders the growth of young forests. That is usual on good spruce land. There are planted four-year-old transplants from four to five feet apart, so that the number of plants on a tunnland (1.22 acres) varies between 2,250 and 3,500. The average number of trees standing on an acre at the time of cutting is very different, depending on previous cuttings. To more fully answer this question as to old forest on gravelly land which has not been subjected to other cuttings than the thinning of too crowded trees and cuttings of defective trees, the number of trees on two tracts, each of two and a half acres extent, have been counted with the following

result: First tract, average pine land, pure stand of pine; average age, 135 years; average height, 85 feet; diameter measured 5 feet from ground. There were found 8 trees with diameter of 5 inches, 13 of 6 inches, 20 of 7 inches, 27 of 8 inches, 34 of 9 inches, 42 of 10 inches, 44 of 11 inches, 44 of 12 inches, 53 of 13 inches, 40 of 14 inches, 30 of 15 inches, 16 of 16 inches, 11 of 17 inches, 3 of 18 inches, 2 of 19 inches; total, 385 trees, containing 9,178 cubic feet. Second tract, good pine land; young spruce successively grown up; pine of average age of 130 years and average height 85 feet; there were found 3 pines and 37 spruces 5 inches in diameter, 44 pines and 58 spruces 6 inches, 61 pines and 37 spruces 7 inches, 77 pines and 28 spruces 8 inches, 76 pines and 11 spruces 9 inches, 82 pines and 7 spruces 10 inches, 83 pines and 6 spruces 11 inches, 73 pines and 3 spruces 12 inches, 53 pines and 1 spruce 13 inches, 30 pines 14 inches, 14 pines 15 inches, 9 pines 16 inches, 5 pines 17 inches, 1 pine 19 inches, 2 pines 20 inches (in diameter); total, 613 pines and 188 spruces, in all 12,013 cubic feet.

Thus were found about 300 trees left per "tunnland" of about 5,300 cubic feet, which, according to an average age of 133 years, shows a yearly average growth of 40 cubic feet per "tunnland" (1.22 acres). If, on the other hand, timber cutting is done once or twice before the final cutting, as is usual, the number of trees at the last is much less. To prevent forest fires, during very dry weather, strict watch is kept by 30 forest guards and by extra ones, and in addition all of the company's dependents are obliged, when a forest fire breaks out, to send notice to the forest guard or forest manager and assist in extinguishing it. Generally the precautions are effective in preventing such fires. No forest fire worthy of mention has occurred in twenty years.

The company's land has been used for forest more than

100 years. It cannot be said what the net revenue is per acre, as the greater part of the product is used at the works in form of coal or fuel. The average yearly growth per "tunnland" ought to be 40 cubic feet, of which one fourth, or 10 cubic feet, should be saw timber of the net value of 1.50 kronor; 10 cubic feet of building timber, worth 1 kronor; 20 cubic feet of wood, worth 0.70 kronor, or, for the 40 cubic feet, 3.20 kronor (equal to $0.85).

The income from game is not large. There are shot annually 12 elks, many hares and game birds.

SWITZERLAND.

The Swiss Confederation is composed of twenty-two cantons, which are separate and sovereign states; and while each canton has legislative authority over forests, the Confederation also exercises legislative authority over them in certain regards. Under article 24, of the Federal Constitution of May 29, 1894, the Confederation controls only the forests of the high regions, which are about 65 per cent of the total forest area of Switzerland. It is true that since the popular vote of July 11, 1897, which revises the said article 24, the Confederation has from now on the right of inspection of the forest police of the whole of Switzerland.

The federal law of March 24, 1876, which puts into execution the above-named article 24 of the constitution, was promulgated for the forests of the high regions. By the terms of that law the inspection by the Confederation extends over the entire territory of the cantons of Uri, Schwytz, Unterwald, Glaris, Appenzell, Grisons, Tessin and Valais and over the mountainous parts of the cantonal territories of Zurich, Berne, Luzerne, Zoug, Friburg, St. Gall, Jura and Vaud; but the law does not apply to the forests of the plains of the last mentioned

states, nor to the forests of the cantons of Soleure, Bale, Schaffhouse, Argovia, Thurgovia, Neufchatel and Geneva.

The Confederation is not actually the owner of any forests, but a few of the separate states are owners. The forest domains are part of the national wealth, and comprise 91,587 acres. There are also in the cantons the forests of the municipalities and of the corporations, comprising 1,403,772 acres. Besides there are private forests, comprising 609,855 acres. The total area of forests is therefore 2,105,220 acres, or about 20 per cent of the total area of Switzerland.

Forests are found everywhere in Switzerland. The parts most heavily timbered are the mountain chains of Jura and of the cantons of Schaffhouse, Soleure, Argovie and Neufchatel. Forests are found starting at 200 meters above sea level (in the canton of Tessin) and reach as high as 2,100 meters in the high mountains. In Argovia they even reach 2,300 meters in altitude.

The more common varieties of trees are among the resinous kinds, the opicea, the fir, the larch, the Scotch and mountain pines, the Siberian pine; among the deciduous kinds, the birch and the chestnut tree; this last kind grows especially in the canton of Tessin.

The value of forest land varies greatly and depends on the location, the nature of the soil, thickness of the settlements, the increase of these settlements and on the trade in timber and other products of the forest. The value per hectare (2½ acres) may range accordingly from 300 francs to 6,000 francs.

In regard to expenses of administration, a distinction must be made between the expenses incurred by the Confederation and those incurred by the cantons. In 1897 the expenses incurred by the Confederation for forest administration amounted to $56,000.

The following are the net receipts from forests in 1896 as to a few cantons:

Zurich, 180,900 francs, or 91.06 francs per hectare of forest.
Berne, 893,000 francs, or 71 francs per hectare of forest.
Soleure, 33,400 francs, or 44 francs per hectar of forest.
St. Gall, 71,000 francs, or 84.60 francs per hectare of forest.
Argovie, 241,000 fracs, or 78.73 francs per hectare of forest.
Vaud, 236,000 francs, or 32 francs per hectare of forest.

The net receipts from town and municipal corporation forests in 1896 were:

Canton of Grisons, 1,200,000 francs, or 10.40 francs per hectare of forest.
Canton of Argovie, 2,378,000 francs, or 70.60 francs per hectare of forest.

On an average about 412 acres of forest have been created annually during the past twenty years, at the expense of the federal treasury.

In order to regenerate the forests, both planting and natural seeding are practiced, as may be most effective.

In the lowest countries, where clean cutting is practiced, planting is resorted to. Where real dangers exist from avalanches, land-sliding, etc., which do not permit complete denudation, and where gardening is required, natural modes of regeneration are generally used, and sowing is seldom done.

Reforesting by the Confederation in high mountain regions costs on an average 400 francs per hectare for 6,000 to 7,000 plants set in their places.

The federal and cantonal legislatures prescribe a sustained production for the forests of the state, of the towns and of the municipal corporations. If, through winds, snow-slidings or otherwise, too much timber has been destroyed, less cutting is done in the following years, in order that as rapidly as possible the forest may regain the number of trees fixed by the management. The forests are operated in various ways, according to localities and ac-

cording to the size of timber that is to be grown, viz., high forest, under-growth and coppice.

In accordance with the terms of the federal law, the forest area cannot be reduced. The cleared land must consequently be reforested except in cases where an equal area of land is covered into forest. Furthermore, the cantons as well as the Confederation have the right to compel the creation of protective forests wherever they are needed for public utility.

Forest fires seldom occur. Of those which do occur the principal causes are carelessness in lighting fires in the immediate vicinity of the forests, and lack of care in the woods. It is rare that a forest fire is occasioned by locomotives.

The administration charged to execute the federal forest law is the Federal Inspectorate of Forests, forming a part of the Swiss federal department of the interior. Nearly all the cantons have for their territories a forest administration. In the small states one single technical official is at the head of the service, but in the larger cantons the administration is under the direction of one or more chief forest inspectors or chiefs of the service and of several district foresters or forest inspectors. An inferior personnel instructed for the federal zone in courses lasting two months is attached to this technical personnel, and is organized to execute the work of forest economy.

A few cities or towns with extended and important forests have also a self forest administration, at the head of which is a person of technical forest training. Among them are Zurich, Berne, Lausanne, St. Gall, Winterhue, Friburg, Coire, Soleure, Schaffhouse.

The Chief Federal Inspector of Forests has an annual salary of 8,000 francs and fees of eight francs per day, and eight francs per night, when he has to be absent, for his service; he gets his traveling expenses reimbursed,

his first assistant has a salary of 6,400 francs and is similarly indemnified for his inspection trips.

The three inspectors of the canton of Berne receive each 5,300 francs per annum. They receive extra pay, six francs per day and four francs per night, for all inspections made outside of their city, and their traveling expenses are reimbursed.

The high forester or chief inspector of the canton of St. Gall, who has a salary of 5,000 francs, receives ten francs per day and four francs per night, besides his traveling expenses, when out inspecting.

The Federal Inspectorate of Forests publishes every year a report on its management. The majority of the cantonal inspectors do likewise.

In the matter of taxes, the cantons are sovereign in their own limits. Taxation therefore differs according to the cantonal territory to which it applies. In all these states a tax on the forest is imposed, and in most states that tax is combined with the tax on income. But for one and the same forest only one of these two modes of taxation is generally applied. A few examples will show: In the canton of St. Gall the state has paid to the towns in which it has forests a tax of 1.20 francs per hectare. In Argovie the state pays to the towns where its forests are situated a tax of 2.40 to 3.20 francs per 1,000 francs of forest value. On the other hand, the towns only pay to the state a tax of 40 centimes per 1,000 francs of forest value. The private forest proprietor pays to the state 40 centimes and from 2.40 francs to 3.20 francs to the towns per 1,000 francs of forest value; and in addition thereto he is taxed on the income in the amount of one per cent of the average two per cent of gross declared value of the forest, but neither the state nor the towns pay a tax on the income of their forests.

WURTEMBERG.

Wurtemberg lies west of Bavaria, and is the third German state in point of area, its population being a little over 2,000,000. Its greatest length from north to south is 140 miles, and its greatest breadth is 100 miles. One-third of the Black Forest (so called from the dark foliage of its pines), and which forms a sort of a triangle, lies within Wurtemberg, two-thirds being in Baden. The Black Forest has a total length of 93 miles, and its breadth varies from 13 to 46 miles.

STATE FORESTS.

The aggregate extent of the state forests is 418,904 acres, and they extend over the entire kingdom. Fifty-nine per cent of the forests consists of pine, 20 per cent being pitch pine and 9 per cent white pine. The estimated value of the forest land varies from $29 to $58 per acre. The annual aggregate expense of administration of the forest amounts to $1,183,574. Of this $364,140 is paid to wood-cutters, $147,560 is expended on roads, $90,440 in forest culture, $259,468 for pay of officials, $148,468 for forest guards. The revenue was $2,928,352, yielding a net revenue, after for 1895-1896 deducting all expenditures, of $1,744,788, or $3.63 per acre. The number of acres annually sown to forest is 296, and the number of acres planted to forest 6,177.

In regard to reforesting, when the natural seeding of the desired kind of wood occurs in proper time the same is used ; otherwise planting or artificial growing takes place. Natural sowing is estimated at about 25 per cent ; artificial renewing amounts to about 75 per cent. The latter is almost exclusively done by planting, whereas sowing in free woodland is very seldom applied. It is a principle to maintain (as far as the division of the age of the plantings

permit) an equal annual cutting. At present the cutting is fixed at 1.94 cubic meters per acre. The cutting is contracted for with laborers living in the neighborhood of the woods. By good management there are at a given plot generally trees of about the same age. If the natural seed falling is intended to be used, the larger trees, either single or in crops, are cut out in a direction against the prevailing winds; the remaining trees are thinned and gradually cut out as the growing young trees may demand. If the natural seed falling is not taken into consideration, the wood crop is cut clean in narrow strips, also in a direction against the prevailing winds, and the cutting of the second and following strips is postponed until the young plantings can dispense with the side protection of the old woods. It is a principle that replanting follows immediately after the cuttings. Moreover, the state buys every year about 400 acres of woodland to increase and round off the forests.

The amount of damage annually caused by forest fires is only $642.60, and the principal cause of such fires is carelessness and negligence while smoking and lighting fires in or near the forests. In the last ten years, out of 120 forest fires only 8 were caused by sparks from locomotives, and of these only one caused considerable damage (about $3,570).

In regard to the rank in the forest service, as compared with other branches of the public service, it may be said that the forest officials rank in general equally with those state officials who are graduates of the university. The Department of Forests is directed by one president, four technical and four administrative members and one commander of the forest guards. The salary of the president is $1,844.50 per year; the salary of the members of the Board of Direction is from $1,190 to $1,618. A work entitled "The Forests of Wurtemberg," published by

Lake Superior Forest Reserve looking north on Elbow Lake. Distant highland is the shore of Wigwam Lake. Photographed July 14, 1903, for the annual report of the Chief Forest Fire Warden of Minnesota.

Rueger, Stuttgart, 1880, gives a fair review of the situation of the forestry of the country. It may here be stated that in respect to net revenue Saxony and Wurtemberg stand at the head of forest administration and forest culture in general.

PRIVATE FORESTS.

The aggregate extent of private forests is 528,794 acres, of which 210,000 acres are administered by technical forest officials; the remainder is also administered in a proper manner. As the permission of the government is required for cutting and replanting of forest lands, and this permission is only given under the condition that an equal area to what has been cut shall be planted, the aggregate area of forest land remains the same throughout the whole country; but portions of it are gradually coming into the possession of the state government.

FREDERICK THE GREAT, THE FATHER OF GERMAN FORESTRY.

Frederick the Great promulgated laws in 1740 and 1754 for regulating the cutting of wood, which previously had been done as everyone pleased, without any regard to replanting. In place of such improvident practice he established rotations of 70 years; that is, he provided that forests should have 70 years in which to mature before being cut, also prescribed methods of thinning so that the young and healthy growth of oak and beech would be better protected. Later instructions were issued in 1764, 1770, 1780, 1783. In addition to this he instituted communal forests under the care of wardens, forbade private owners from every wasteful cutting and placed under the care of the state a portion of the forests in Silisia which previously

had belonged to private parties. Frederick the Great ordered the division of the national forests into compartments or blocks, each of which was to acquire the age of 70 years before being cut. But inasmuch as it was found that 70 years were not sufficient for the proper growth of the trees, each of these main compartments were subdivided into two compartments, so that a period of growth running 140 years was established.

There had been, in more ancient times, laws relating to forests for certain parts of Prussia, the first dating 1547. These related to the right of using the forest and necessity of replanting, more than to general systematic care. One can therefore properly claim that Frederick the Great is the father of the German forests, as it was he who created the existing forestry laws and made them apply to private as well as to state forests.

The Working Plan.

The "Manual of Forestry" in five volumes, by Dr. William Schlich, principal professor of forestry at the Royal Indian Engineering College, Cooper's Hill, England, and formerly Inspector General of Forests to the Government of India, is the best work on the subject in the English language. Dr. Schlich has kindly given me permission to copy from his third volume an account of the "working plan" as used in forestry, and what follows on that subject is taken from that volume.

Forest working plans regulate, according to time and locality, the management of forests in such a manner that the objects of the industry are as fully as possible realized. The working plan for a protection forest, or a park-like forest, is altogether different from that of a forest which

is managed on economic principles. The latter is the kind with which we have here to do.

The working plan report is a document which gives necessary information and which describes the system of management in such detail as may be required in each case. For forests which are of great value, and which yield high returns, very detailed plans should be drawn up; for forests which give as yet only small returns, simple plans would be indicated.

Working Plan Report.

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7. Legal position of forest, rights and privileges.
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WORKING PLAN FOR A PORTION OF THE STATE FORESTS OF THE HERRENWIES RANGE IN THE BLACK FOREST, GRAND DUCHY OF BADEN.

PERIOD 1884—1893.

WITH THE RESULTS OF THE ACTUAL WORKING.

GENERAL DESCRIPTION.

1. *Area and Boundaries.*

The areas are recorded as follows:

(*a*) Productive area	1,747 acres
(*b*) Unproductive area	nil. "
(*c*) Other areas, including fields, meadows, etc. . .	2 "
Total area	= 1,749 acres

Alterations in the above figures will probably become necessary when a fresh survey is made.

The outer boundaries are in order, but the internal boundaries require rectification.

2. *Locality.*

The forest here in question occupies on the whole the slopes lying between a hill range on the south and the river Schwarzenbach on the north. The highest point of the hill range, the Hoher Ochsenkopf, has an elevation of 3,465 feet above the sea, while the lowest part, near the Schwarzenbach, is only 2,000 feet above the sea, the mean elevation being placed at 2,600 feet.

The slopes, on which the forest is found, are mostly steep, level spots being only found on the summits of the hills, and toward the lower end, where granite and Bunter Sandstein meet.

The area is drained by the Schwarzenbach (a feeder of the Raumünzach) with its two feeders, the Gartenbach and Dobelbach. The first mentioned runs from west to east, and the two latter, more or less, from south-west toward north-east. It follows that the forest in the valley of the Schwarzenbach has generally a north aspect, and in the valleys of the Gartenbach and Dobelbach a northwest aspect on one side, and a southeast aspect on the other side of the streams. All the forest areas (except those situated at the highest elevations and which are of no importance) are protected by intervening ranges against the prevailing winds.

Up to a mean elevation of 2,500 feet, granite is the principal rock, which is sometimes (though rarely) pierced by porphyry. Above the afore-mentioned elevation the granite underlies upper Bunter Sandstein (Vogesen Sandstein), and the latter accordingly prevails in the larger part of the forest area.

The granite is generally rich in orthoclase and oligoclase, and therefore decomposes readily, and furnishes mostly a deep soil rich in mineral elements. The decomposition is facilitated, and the quality of the soil improved, by the remarkably numerous springs which appear between the granite and the Bunter Sandstein. Hard slow decomposing quartzite is of rare occurrence.

The Bunter Sandstein is characterized by rapidly and greatly changing mineral composition, consisting sometimes of readily decomposing rock yielding a deep clay soil, in other cases of hard quartz-gravel, frequently found on the surface in the numerous bolder-drifts. The Bunter Sandstein has numerous rents and fissures in all directions, so that it is rapidly drained, and the disintegration and decomposition are only rarely assisted by springs, which at the best are scanty and intermittent. It follows that the Bunter Sandstein soils, even when formed by the easily decomposed and minerally rich clay sandstone, never equal the best quality of the granite soil; moreover, they change frequently and very suddenly, and without any visible cause, into almost unproductive areas.

On the flat hill tops, layers of fine white sand (produced by the disintegration of the gravelly sandstone) frequently produces an impermeable stratum, preventing the water from percolating, thus causing bogs (or "Grinde") which often extend over considerable areas and are almost unproductive.

The quality of the soil, therefore, ranges between good and unproductive, in the following proportion:

Good and fairly good to medium	= 78 per cent.
Medium to indifferent	= 12 "
Indifferent to unproductive	= 10 "

The climate is rough, and is characterized by long winters with an abundant snowfall, and by rapid changes of temperature; at the same time it is throughout favorable for forest vegetation, especially for conifers.

3. *Species.*

The details will be found in the description of compartments. Generally speaking, the spruce and silver fir are the prevailing trees, the former being more abundant in the middle and upper parts, the latter at the lower elevations. The beech is associated with them locally and in varying proportions. Scotch pine is found in the granite region chiefly upon dry, steep, rocky slopes with a southerly aspect, and in the sandstone region, especially on dry ridges and the top of the mountains, as well as here and there in other localities. The three conifers attain a maximum height of 140 feet, with regular shaped and little tapering stems. Toward the upper limit of the area the height growth diminishes rapidly, dwindling down to 20 or even 15 feet on the high plateaux. Here the mountain pine and the birch are also found. Reproduction is generally good, except at the higher elevations. A marked difference is found between northern and southern slopes, the growth and reproduction being far more vigorous on the former than on the latter.

The silver fir is much exposed to cancer. Windfalls and snow breakage are fairly moderate, while the damage from insect attacks is very small. During the years 1874-83, the following proportion existed between the different classes of fellings:

Cuttings caused by insect attacks	= 1	per cent of total fellings.	
" " snow breaks	= 12	"	"
" " windfalls	= 16	"	"
Cancer and other diseases and injury	= 19	"	"
Other cuttings	= 52	"	"
Total	= 100	"	"

4. *Method of Treatment and Rotation.*

The situation and the species necessitate the area being treated under the high forest system. The quality gradations, as indicated under 2, are so conspicuous locally that it is possible (as well as desirable in order to secure a proper idea of the condition of the forest), to group the growing stock according to its characteristics as produced by the quality of the locality, and according to the method of treatment thereby indicated. The actual basis of this grouping is the yield, and based upon it, the net income or financial result of the management. In this sense the forest may be divided into the following three groups:

a. Areas Subjected to an Intensive Management.—To this group belong all areas which, in virtue of their quality (as indicated mainly by the height growth of the trees on fully stocked areas) are capable of producing large timber; areas on which carefully conducted regeneration fellings will produce natural regeneration within a reasonable period of time, and where the cost of any artificial assistance in regeneration is commensurate with the anticipated returns. As lowest limit of this group a normal increment of 43 cubic feet per year and acre, calculated for a rotation of 120 years, has been fixed. The area thus included in the group amounts to 78 per cent of the whole. It is with this area, and the growing stock standing on it, that the management must more especially reckon, and from which the

largest possible sustained yield must be secured. With a suitable composition of the growing stock and a careful application of sylvicultural principles, that object may be obtained under an average rotation of 120 years.

As regards the sylvicultural treatment, and especially the regeneration of the woods, two different classes of forest or growing stock (corresponding with two qualities of locality) stand out prominently.

First: Forest of spruce with a strong admixture of silver fir (the latter occasionally predominating) more or less frequently interspersed with beech and more rarely with Scotch pine.

Secondly: Forest in which spruce prodominates with a slight admixture of silver fir and here and there of Scotch pine, but devoid of beech.

The first class of forest occurs in the granite area and on those parts of the Bunter Sandstein (clay sandstone), which have deep, easily decomposed soils fit to be classed as good. The characteristic features of this class of forest are the occurrence of beech and deep soils, rarely covered with boulders or debris, lying mostly at the lower elevations; natural regeneration can here be successfully effected in a comparatively short period of time.

The second class of forest occupies the stony slopes of the Bunter Sandstein area, and in exceptional cases the quartzite parts of the granite area. Here the soil is generally covered with loose boulders and rock debries of varying size. These areas are nearly all found at the middle to upper elevations. The conditions described demand the maintenance of an uninterrupted canopy up to the age of maturity, and a careful execution of the regeneration cuttings spread over a prolonged period of time, or else weeds will spring up, which make regeneration very difficult, and at any rate expensive.

On the whole, however, careful management is sure to be successful in securing natural regeneration in all the areas pertaining to this group; for this purpose, as well as for the production of valuable timber, a rotation of 120 years on an average is considered of sufficient length. The length of the regeneration period differs considerably in the different parts, varying on the whole from 30 to 50 years.

b. The second group consists of woods growing on soils, which, even under the most careful management, cannot be expected to produce trees of first or even second quality. The trees here produced are of such limited height growth, that the production of valuable timber is out of the question. The woods are found in the upper, and here and there in the lower part of the Bunter Sandstein area, where the soil is covered with large masses of the debris of gravelly sandstone, which is not easily decomposed, and where the slightest interruption of the canopy overhead is followed by the appearance of a dense growth of bilberry and heather.

Nevertheless, these areas are capable of yielding timber of the inferior classes, as well as firewood, and the returns which may reasonably be expected from them, justify the application of a method of treatment which, while avoiding any interruption in the canopy and all expensive cultural operations, facilitates natural regeneration; in other words the treatment under the selection system by removing all trees which are deteriorating or incapable of increasing in value. It is difficult to fix any definite rotation, but it is estimated that the trees will take about 150 years to reach maturity.

The lowest quality limit for this group has been fixed at 7 cubic feet increment per acre and year, while the upper limit is, as already indicated, 43 cubic feet. The area comprised in this group amounts to 12 per cent of the total area.

c. The third group comprises the so-called "Grinden," that is to say the highest parts of the ridges, which are mostly level and have a tendency to bogginess. They are covered by a dense growth of bilberry and heather, and are incapable of producing more than a stunted tree growth, which yields only a scanty quantity of firewood, frequently not covering the price of preparing it; hence financial considerations are entirely out of the question, the areas being protected merely for the sake of preserving some cover on the hill tops. The group comprises all parts which produce an annual increment per acre of 7 cubic feet and under; they amount to 10 per cent of the total area.

In so far as the management aims at the production of valuable material, and at favorable financial results as regards outlay for artificial regeneration (where natural regeneration has failed), for improvement, tending, etc., only the areas in the first group can be considered. But in the treatment of those forests which pertain to the principal mountain region of the Black Forest, representing a certain drainage area, the task of forestry goes beyond mere financial considerations. It has in fact been recognized that it is necessary to keep areas of this class well wooded for the sake of a proper husbanding of the water supply in the streams. Accepting this further task, the forest administration has endeavored, during the last 50 years, to afforest the poorly stocked and frequently entirely bare areas at the higher elevations of the Bunter Sandstein region. In so far as the cultural operations were confined to the boulder drifts of the Bunter Sandstein, they were moderately successful, but the cultural attempts made in the "Grinden" prior to 1870 turned out failures. Since 1873 the cultural operations in the Grinden present a more hopeful aspect, owing to the experience gained by former failures, and it seems desirable to continue them in the future.

The working plan deals in detail only with the forest area subjected to intensive management, but the group worked under the selection system has also been adequately noticed in the general provisions.

The working plan lays special stress upon the execution of improvement fellings, more particularly the removal of cancerous silver firs. For this purpose the ordinary thinnings are utilized; but over and above these, cancerous trees must also be removed from the old woods, where otherwise no further thinnings would be required. In regeneration fellings the trees to fall first under the axe must be those attacked by cancer. Even then not nearly all cancerous trees can be removed during the next ten years. This fact teaches the management that in future a sharp attack must be made on all cancerous trees at the time of the first and second thinnings, even if a temporary interruption of the canopy should thereby be caused. On the rich deep soils of the granite area, which are almost exclusively concerned in these remarks, even an interruption of the canopy extending over a somewhat lengthy period would not be a misfortune, and preferable to the maintenance of a full canopy consisting to a considerable extent of cancerous trees. The existence of enormous quantities of such trees on the granite area was one of the reasons which led to the yield being fixed at its present rate.

5. *Utilization.*

a. Yield of Major Produce.—The actual yield during the last 40 years has been as follows:

Shore of Lake Bellissami, Lake Superior Forest Reserve, July 13, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota.

Compartment.	Yield, in Solid Cubic Feet.					
	1844-53.	1854-63.	1864-73.	1874-83.	Total.	Area in Acres.
1. Schwarzenbronn....	213,836	122,369	149,843	79,141	565,189	65
2. Schwarzenberg.....	311,518	158,778	200,733	158,955	829,984	211
3. Riesenkopf.....	12,502	47,288	206,242	65,617	331,649	76
4. Mehliskopf.....	.....	.....	.....	.....	.....	84
5. Grünwinkel.....	19,742	124,629	57,423	202,252	404,046	202
6. Dobelbach.....	26,875	42,697	30,195	69,952	169,692	178
7. Hoher Ochsenkopf..	.....	.....	.....	.....	.....	101
8. Kleingartenkopf....	34,256	2,331	1,448	1,024	39,059	76
9. Kleingarten.....	375,687	188,825	256,603	195,578	966,693	362
10. Grossgarten.....	62,544	46,688	26,417	59,118	194,767	175
11. Sachsenbronn.....	34,927	47,788	111,351	106,194	300,255	95
12. Gartenbach.....	86,311	83,845	494,665	156,412	820,733	172
	1,178,198	814,733	1,534,920	1,094,216	4,622,067	1,747
Average per year.....	117,820	81,473	153,492	109,422	115,552	.....
Average per year and acre.....	67.44	46.64	87.86	62.63	66.14	.....

From the appended statistical table it will be seen that the estimated increment of the next ten years amounts to 1,086,130 cubic feet.

The actual growing stock amounts to 9,488,731 cubic feet
The normal " " 7,892,160 "

The surplus of " " 1,596,571 "

The surplus of growing stock is due to a surplus of woods over 100 years old. With favorable prices for timber, the removal of this surplus in the shortest possible time would be advisable, so as to prevent loss of increment, and take unnecessary capitol out of the forest, but as prices run low at present, it appears judicious to keep the greater part of it over for a while.

A consideration of the several compartments showed that the removal of the following material during the next ten years is advisable on sylvicultural grounds:

Final cuttings . . . 1,146,000 cubic feet
Intermediate cuttings . . . 154,000 "

Total . . . 1,300,000 "

As this amount exceeds the expected increment by 213,870 cubic feet, equal to about one-seventh of the surplus of growing stocks, the yield has been fixed at 1,300,000 cubic feet, or annually:—

Final cuttings . . . 114,600 cubic feet
Intermediate cuttings . . . 15,400 "

Total . . . 130,000 "

If in the course of the 10 years prices should rise, there would be no objection to reduce the surplus of growing stock further by additional cuttings.

The disposal of the yield is effected as follows:

1) Free grant to the Roman Catholic Priest at Herrenwies,	=	1,500 cubic feet.
" " " School "	=	1,000 "
(2) Sale by public auction and occasionally by private sale,	=	127,500 "
Total annual disposals		130,000 "

b. Minor Produce.—The principal items are forest pasture and the removal of litter, the utilization of which is permitted to the Herrenwies settlers, as a privilege.

According to government orders the privilege of forest pasture may be exercised only to such extent as the condition of the forest and the requirements of regeneration may permit. The district forest officer indicates from time to time the localities in which the privilege may be exercised. The privilege of removing litter free of charge is exercised under the same conditions. The exercise of these privileges is nowhere injurious, and may be continued during the next ten years.

The grass growing in blanks, on roads and in plantations has hitherto been sold for the benefit of the State, and, under suitable supervision, the practice may be continued.

The removal of building stones, the sale of plants, etc., is insignificant.

6. *Division into Compartments.*

The contemplated new division into compartments must be postponed until the projected road system has been completed.

DESCRIPTION OF COMPARTMENTS.

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
I. Ochsenköpfe.			
Schwarzenbronn	1	65	Spruce with silver fir, some beech, Scotch pine, larch. About .6 of area 30—50 years old, some trees older. About .4 of area 10—30 years old. Above the road fairly complete stocking; in youngest parts still suffering from frost; below road still some blanks caused by late cutting out of old trees; in the latter part still 120—150 years old spruce and silver fir in the final stage; these show a decreasing increment. Growth on the whole fairly good.
Schwarzenberg	2	211	*a* = 130 acres; 15—40 years old spruce and silver fir with some Scotch pine and beech; some lately planted, younger, a few up to 60 years old. About 25 acres planted. Where the shelter wood has been removed, stocking generally complete, in the rest still patchy with patches of bilberry intervening. Growth generally between good and fairly good; along Herrenwies meadows partly only fair, the spruce still suffering from frost. In the north-western part, below the road, on the Riesenkopf road, and in the south-east along Dobelbach, on about 37 acres 110—140 years old spruce and silver firs of decreasing increment are standing in the final stage.

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
			b — 81 acres (in three parts), spruce and silver fir with a few beech and Scotch pine, generally 50—75 years old, but some small groups only 30—50 years old; generally well stocked, here and there somewhat thin and patchy. Growth between good and fairly good. On 8 acres on the Dobelbach, 80—90 years old spruce, cover complete and growth good.
Riesenkopf.....	3	76	*a* — 47 acres; 100—130 years old spruce and silver fir, some older; on the whole cover fairly complete; toward compartment Schwarzenberg somewhat thin, but on about 10 acres with a fair young crop of silver fir and spruce up to 15 years old. Growth fairly good, on the higher part inferior. About 5 acres along the road is a windfall area, now stocked with some silver fir and spruce growth. *b* — 24 acres; 9—20 years old spruce (a few older), with some Scotch pine and larch, mostly well stocked, showing good to fairly good growth. *c* — 5 acres; Grinde, in upper part heather covered, with 100 and more years old short and stunted Scotch pine, some spruce and mountain pine. On the whole poorly stocked. Part underplanted with 20—40 years old spruce, which show very poor growth.
Mehliskopf.....	4	34	50—90 years old (and more), mountain pine with some spruce, Scotch pine, birch and mountain ash; toward compartments 3 and 5 cover fairly complete, in the southern and south-western parts interrupted by larger and smaller areas of heather. Growth inferior.
Grünwinkel.....	5	202	*a* — 186 acres; 110—150 years old, some older, spruce and silver fir, some beech with a few Scotch pine. In irregular final and seeding stage, in the southern part cover still fairly complete in strips. On .4 of the area stocked with up to 80 years old silver fir and spruce and a few beech. Growth of old trees still fairly good; on some stony ridges (about 7 acres) middling and inferior; young growth mostly only middling. *b* — 16 acres on the highest part in the south and west, Grinde; heather-ground with 100 and more years old crippled Scotch pine, spruce, some mountain pine and birch; in some parts up to 60 years old advance growth thinly stocked. Here and there traces of plantings, 24 years old spruce.
Dobelbach.....	6	178	*a* — 133 acres; 100—130 years old, some up to 200 years, spruce and silver fir, some Scotch pine; on the whole cover fairly complete; only in the western third along Grünwinkel through windfalls and dry wood cuttings somewhat thin and patchy; in the thin parts as yet little, up to 15 years old, advance growth in single trees. Growth good to fairly good. (Ilex found). *b* — 27 acres (consisting of the upper south-eastern portion and a ridge running from it in a north-western direction to the centre of the compartment), 100—130 years old (some older), short-stemmed spruce with some Scotch pine and silver fir forming a thin, often very thin, wood; in parts younger up to 60 years old spruce, or an incomplete miserable under-

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
			growth of 25 years old spruce and Scotch pine (experimental planting). Growth middling to inferior. *c* = 18 acres (uppermost part on the south) Grinde; heather land with 100 years and more old crippled Scotch pine, some spruce, birch thinly stocked; here and there remnants of 25 years old planted spruce and Scotch pine.
Hoher Ochsen.....	7	101	70 and up to over 100 years old Scotch pine and mountain pine with spruce, some birch, sometimes forming a very thin wood of single trees, sometimes in smaller or larger groups; everywhere intersected by heather places and blanks. Growth inferior, even crippled.
Kleingartenkopf.....	8	76	100—120 years old, in some parts younger, some over 300 years old, spruce with Scotch pine, few silver fir, some mountain pine. In the western third and on the eastern point still fairly well stocked, some groups even well stocked; otherwise the wood is very thin and open. Growth middling to inferior; here and there an incomplete miserable undergrowth of 30—50 and more years old spruce and Scotch pine (planted).
Kleingarten.....	9	362	*a* = 161 acres; spruce and silver fir, some beech. Mostly 50—80 years old, in strips and single trees up to 100 years old, others only 30—50 years old. In the eastern part are about 50 acres 80—100 years old. Everywhere spruce and silver fir standards up to 150 years old, mostly showing good growth. Almost throughout rather thinly stocked, here and there patchy, in consequence of late final cuttings and removal of cancerous silver firs. Growth mostly good, only toward the southern higher part decreasing. *b* = 122 acres (in 8 places); spruce and silver fir with some beech, $\frac{15—40}{\text{average} = 80}$ years old, some groups up to 50 years; mostly fully stocked. 120—150 years old (some older) mostly pruned spruce and silver firs in the final stage are standing almost everywhere over the above younger growth. The strip along Dobelbach is finally cleared. Growth good; of the old trees fairly good. *c* = 79 acres (upper part toward the south), 120—300 years old pruned Scotch pine and spruce, few silver fir and birch, thinly stocked, often open; on the whole poorly undergrown with 20—50 years old spruce (mostly planted), a few silver fir; the latter in some places form, with up to 100 years old spruce, the picture of a selection forest. Soil much covered with heather. Growth middling to bad; rarely fairly good. On 6 acres near compartment Dobelbach on the main path, 100 and more years old spruce, with a few Scotch pine and silver fir, form a thin canopy and show middling growth.
Grossgarten.....	10	175	*a* = 108 acres; spruce and silver fir 80—110 years old, some up to 150, some beech and a few Scotch pine. Partly fully stocked, but the greater part somewhat thin, in the lower part very thin; and here spruce and silver fir advance growth up to 50 years old in single trees and groups. Growth good to fairly good; in

DESCRIPTION OF COMPARTMENTS—*Continued.*

Block and Compartment.		Area in Acres.	Description of Wood.
Name.	No.		
			the upper parts with stones (Halde), partly middling only. *b* — 37 acres. (Ridge through middle of compartment and strip on south, southwest, and northwest.) 90—110, some up to 200 years old, spruce and Scotch pine, some silver firs, in the uppermost part some mountain pine in a thin, patchy, and often very thin wood; most of inferior growth; here and there traces of 30—40 years old spruce plantings. *c* — 30 acres (adjoining compartment Kleingarten). A wood resembling a selection forest, of spruce and silver fir with beech, the trees 30—50 years old prevailing; little quite young. The 100—120 years old and older trees appear single and in groups. Growth good; above the cattle track inferior.
Sachsenbronn.....	11	95 (and 2 acres other areas.)	100—120 years old (some up to 200 years), spruce and silver fir, also some beech, namely: On 42 acres, final stage, partly pruned, throughout with $\frac{10-30}{20}$ years old (in the western part up to 40 years old), silver fir and spruce young growth; about 25 acres in the position of the seeding stage brought about by windfalls and dry wood cuttings; on 5 acres 80—100 years old, generally complete cover; in the thinner stocked parts is found up to 15 years old silver fir and spruce young growth; on 12 acres (southeastern corner, near compartment Gartenbach) generally canopy complete, here and there with a little advance growth. On 10 acres (in the west), 70—90 years old, some older spruce with silver fir, fairly complete canopy. On 7 acres (western point), 12—40 years old (in groups and single up to 60 years old), mostly irregular young growth of spruce with some silver fir, forming a fairly complete stocking. Growth of old trees good to fairly good, in the pruned portions partly less good; growth of young wood fairly good.
Gartenbach	12	172	110—140 years old spruce, silver fir, some older, some Scotch pine, the latter prevailing in places in the upper part, few beech; in the northern two-thirds in the final stage, partly in seeding stage. In these two-thirds about 85 acres are stocked with young growth of spruce and silver fir pretty completely, in the eastern part very fully; in the southern third still fairly complete cover, but on the western slope, already somewhat thin, as yet little young growth. Growth in northern two-thirds good, in the southern third good to fairly good; in the upper part, in the southeast, only middling. In the middle of the compartment are 3 windfalls and 1 beetle clearing, together 12 acres; of these, 7 acres fairly well stocked with up to 25 years old spruce and silver fir.

TABULAR STATISTICAL REPORT

Compartments.		Distribution of Age					
		1—40 years old.		41—60.		61—80.	
Name.	No.	Cubic feet.	Acres	Cubic feet.	Acres	Cubic feet.	Acres
I. Working-section—Yield-capacity over							
Schwarzenbronn	1	48,080	41	70,680	20	.....	.....
Schwarzenberg	2	200,945	117	169,514	40	192,117	40
Riesenkopf	3	19,072	34	.....	.....	.....	.....
Grünwinkel	5	21,189	88	.....	.....	.....	.....
Dobelbach	6	.....	.....	.....	.....	.....	.....
Kleingarten	9	109,479	87	201,299	37	428,787	67
Grossgarten	10	26,487	24	46,617	11	25,074	5
Sachsenbronn	11	28,605	51	.....	.....	35,316	5
Gartenbach	12	13,420	48	.....	.....	.....	.....
Total	.....	467,227	440	488,080	108	676,294	117
Normal state under a rotation of 120 years	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state +	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state —	.....	.....	.....	.....	.....	.....	.....
II. Working-section—Yield-capacity from							
Dobelbach	6	1,770	.....	.....	.....	.....	.....
Kleingartenkopf	8	10,595	25	.....	.....	.....	.....
Kleingarten	9	10,948	25	.....	.....	.....	.....
Grossgarten	10	.....	.....	.....	.....	.....	.....
Total	.....	23,313	50	.....	.....	.....	.....
Normal state under a rotation of 120 years	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state +	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state —	.....	.....	.....	.....	.....	.....	.....
III. Working-section—Yield-capacity 7							
Riesenkopf	3	.....	.....	.....	.....	.....	.....
Mehliskopf	4	.....	.....	.....	.....	18,900	34
Grünwinkel	5	.....	.....	.....	.....	.....	.....
Dobelbach	6	.....	.....	.....	.....	.....	.....
Hoher Ochsenkopf	7	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	18,900	34
Normal state under a rotation of 120 years	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state +	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state —	.....	.....	.....	.....	.....	.....	.....
Summary of the							
Real state of forest	.....	.....	.....	.....	.....	.....	.....
Normal state of forest	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state +	.....	.....	.....	.....	.....	.....	.....
Comparison of real and normal state —	.....	.....	.....	.....	.....	.....	.....

OF THE HERRENWIES RANGE.

Classes.						Volume per acre, cubic feet.	Increment.			
81—100.		Over 100 years.		Total.			Annual, per acre.		Total in 10 years.	
Cubic ft.	Acres	Cubic ft.	Acres	Cubic ft.	Acres		Normal	Real.	Normal.	Real.
43 cubic feet per Acre Annually.										
.....	.....	34,250	4	152,910	65	2,352	85	70	55,250	45,500
15,892	2	118,662	12	697,130	211	3,304	85	75	179,350	158,250
.....	.....	381,408	37	400,480	71	5,641	70	61	49,700	43,310
.....	.....	1,606,861	148	1,628,050	186	8,753	85	71	158,100	132,060
.....	.....	1,522,104	133	1,522,104	133	11,444	100	71	133,000	94,430
353,156	49	540,329	43	1,628,050	283	5,753	100	78	283,000	220,740
494,418	49	365,870	49	958,466	138	6,945	85	85	117,300	117,300
42,379	5	459,103	34	565,403	95	5,952	100	71	95,000	67,450
.....	.....	1,373,758	124	1,387,178	172	8,065	100	86	172,000	147,920
905,845	105	6,402,345	584	8,989,771	1,354	6,603	.....	76	.....	1,026,960
.....	.....	.....	.....	7,456,200	.....	5,507	92	.....	1,242,700	.....
.....	.....	.....	.....	1,483,571	.....	1,096	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	16	.....	5,740
7 to 43 cubic feet per Acre Annually.										
.....	.....	38,850	27	40,620	27	1,504	30	21	8,100	5,670
.....	.....	203,418	51	214,013	76	2,816	14	14	10,640	10,640
.....	.....	108,419	54	119,367	79	1,511	43	29	33,970	22,910
.....	.....	79,460	37	79,460	37	2,148	21	21	7,770	7,770
.....	.....	430,147	169	453,460	219	2,071	.....	21	.....	46,990
.....	.....	.....	.....	362,880	.....	1,657	28	.....	60,480	.....
.....	.....	.....	.....	90,580	.....	414	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	7	.....	13,490
cubic feet and under per Acre Annually.										
.....	.....	4,500	5	4,500	5	900	7	7	350	350
.....	.....	.....	.....	18,900	34	556	7	7	2,380	2,380
.....	.....	11,300	16	11,300	16	706	7	7	1,120	1,120
.....	.....	7,400	18	7,400	18	411	7	7	1,260	1,260
.....	.....	53,400	101	53,400	101	529	7	7	7,070	7,070
.....	.....	76,600	140	95,500	174	549	.....	7	.....	12,180
.....	.....	.....	.....	73,080	.....	420	7	.....	12,180	.....
.....	.....	.....	.....	22,420	.....	129	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Three Working Sections.										
.....	.....	.....	.....	9,488,731	.....	.....	.....	.....	.....	1,086,130
.....	.....	.....	.....	7,892,160	.....	.....	.....	.....	1,315,360	.....
.....	.....	.....	.....	1,596,571	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	229,230

SPECIAL WORKING PLAN.

Compartments.	Description of Cuttings, Cultivation, Etc.	Cuttings.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Intermediate Cubic feet.			
1. Schwarzenbronn..	Final cutting in regenerated part.....	84,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	3	.....	.....
	Thinning and cutting of cancerous silver firs....	.....	10,000	.....	.....	.....
	Total.....	84,000	10,000	3	.....	.....
2. Schwarzenberg....	*a* Thinning of shelterwood and partial final cutting	85,000	.....	.....	.....	.....
	Filling up blanks with spruce and Scotch pine.	.....	.....	10	.....	.....
	a and *b* Thinning and removal of cancerous trees	.....	58,000	.....	.....	.....
	Total.....	85,000	58,000	10	.....	.....
3. Riesenkopf.....	*a* Seeding cutting, and partly final cutting..... *b* and *c* Rest.	53,000	.....	.....	.....	.....
	Total.....	53,000	.....	.....	.....	.....
4. Mehliskopf.....	Rest.					
5. Grünwinkel.....	*a* Thinning of shelterwood, seeding cutting in the fully stocked parts by the removal of cancerous and large trees..... *b* Rest	318,000	.....	.....	.....	.....
	Total.....	318,000	.....	.....	.....	.....
6. Dobelbach.....	*a* Thinning and removal of cancerous trees..... *b* and *c* Rest.	19,000	19,000	.....	.....	.....
	Construction of an export road to meet the main road.....	.....	.....	.....	.....	4,900
	Total.....	19,000	19,000	.....	.....	4,900
7. Hoher Ochsenkopf	Rest.					
8. Kleingartenkopf..	Rest.					

SPECIAL WORKING PLAN—*Continued.*

Compartments.	Description of Cuttings, Cultivation, Etc.	Cuttings.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final. Cubic feet.	Intermediate Cubic feet.			
9. Kleingarten.....	*a* Cutting of all old standards and cancerous trees.....	45,000	.....	.....	.....	.....
	Thinning.....	.....	3,000	.....	.....	.....
	b Thinning of shelterwood and partially final cutting.....	198,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	12	.....	.....
	c Cutting out of old defective trees where young growth exists...	14,000	.....	.....	.....	.....
	Construction of an export road to meet the main road.....	.....	.....	.....	.....	9,500
	Total.....	257,000	3,000	12	.....	9,500
10. Grossgarten	*a* Thinning and removal of cancerous trees.....	47,000	47,000	.....	.....	.....
	b Rest.					
	c Removal of standards and cancerous trees....	25,000	.....	.....	.....	.....
	Thinning.....	.....	15,000	.....	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	5,000
	Total.....	72,000	62,000	.....	.....	5,000
11. Sachsenbronn....	In the regeneration area: thinning of shelterwood and partially final clearing; in the rest seeding cutting.....	163,000	.....	.....	.....	.....
	Filling up blanks with spruce.....	.....	.....	3	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	3,500
	Total.....	163,000	.....	3	.....	3,500
12. Gartenbach.....	Continuation of regeneration cuttings and removal of cancerous trees.....	195,000	.....	.....	.....	.....
	Thinning in fully stocked parts	.....	7,000	.....	.....	.....
	Filling up blanks with spruce and Scotch pine.	.....	.....	8	.....	.....
	Construction of an export road.....	.....	.....	.....	.....	3,000
	Total.....	195,000	7,000	8	.....	3,000

SUMMARY OF THE PROVISIONS OF THE

Compartment.	Provisions of Working Plan.					
	Cuttings.			Cultivation. Acres.	Draining. Feet.	Road Construction.
	Final. Cubic Feet.	Intermediate. Cubic Feet.	Total Cubic Feet.			
1. Schwarzenbronn.....	34,000	10,000	44,000	8	.....	.....
2. Schwarzenberg.....	35,000	53,000	88,000	10	.....	.....
3. Riesenkopf.....	53,000	.....	53,000	.....	.....	.....
4. Mehliskopf.....	.....	.....	.....	.....	.....	.....
5. Grünwinkel.....	318,000	.....	318,000	.....	.....	.....
6. Dobelbach.....	19,000	19,000	38,000	.....	.....	4,900
7. Hoher Ochsenkopf...	.....	.....	.....	.....	.....	.....
8. Kleingartenkopf.....	.....	.....	.....	.....	.....	.....
9. Kleingarten.....	257,000	3,000	260,000	12	.....	9,500
10. Grossgarten.....	72,000	62,000	134,000	.....	.....	5,000
11. Sachsenbronn.....	163,000	.....	163,000	3	.....	3,500
12. Gartenbach.....	195,000	7,000	202,000	8	.....	3,000
Total.....	1,146,000	154,000	1,300,000	36	.....	25,900

Note.—The excess was due to heavy windfalls; it will not derange future

Rapids in Cross River, Lake Superior Forest Reserve, July 15, 1903. Photographed for the annual report of the Chief Fire Warden of Minnesota.

WORKING PLAN AND OF THE EXECUTION.

Results of Actual Work Done.						Comparison of Proposed and Executed Cuttings.		Remarks.
Cuttings.			Cultivation. Acres.	Draining. Feet.	Road Construction. Feet.	Cut too much. Cubic Feet.	Cut too little. Cubic Feet.	
Final. Cubic Feet.	Intermediate. Cubic Feet.	Total. Cubic Feet.						
33,034	12,549	45,583	4·4	.....	.....	1,583	.....	
54,517	75,000	129,517	5·0	.....	.....	41,517	.....	Excess due to windfalls and snow-break.
132,900	.....	132,900	·1	.....	.....	79,900	.....	Excess due to windfalls and snow-break.
.....	.....	.....	.....	.....	.....	.....	.....	
177,169	.....	177,169	·1	.....	.....	.....	140,881	Held back, on account of extra fellings in other compts.
86,606	68,301	154,907	.....	.....	5,003	116,907	.....	Exeess due to windfalls.
.....	.....	.....	.....	.....	.....	.....	.....	
.....	.....	.....	.....	.....	.....	.....	.....	
342,444	21,635	364,079	8·4	.....	9,679	104,079	.....	Excess: windfalls and construction of road.
95,852	.....	95,852	.....	.....	5,299	.....	88,148	Thinning held over.
111,049	.....	111,049	·9	.....	3,691	.....	51,951	Held back on account of excess in other compartments
197,660	.....	197,660	.....	.....	2,953	.....	4,340	
1,231,231	177,485	1,408,716	18·9	.....	26,625	108,716	.....	

arrangements, as there is yet a considerable excess of growing stock in the forest.

SAMPLE PAGE OF THE DETAILED CONTROL BOOK.

1. *Schwarzenbronn.*

Year.	Description of Cuttings, Cultivation, etc.	Cutting.		Cultivation. Acres.	Draining Ditches. Feet.	Road Construction. Feet.
		Final Cubic feet.	Intermediate Cubic feet.			
Provision of Working Plan.						
	Final cutting in regenerated part..	34,000	.....	.....	.....	.....
	Filling up blanks with spruce	.....	.....	3	.....	.....
	Thinning and cutting of cancerous silver firs.....	.....	10,000	.....	.....	.....
	Total.....	34,000	10,000	3	.....	.....
Execution.						
1884	Final cutting.....	14,297	.....	.....	.....	.....
1884	Dry and windfall wood.....	813	.....	.....	.....	.....
1885	Windfalls	665	.....	.....	.....	.....
1886	Final cutting, thinning.....	6,166	832	.....	.....	.....
1886	Windfalls	547	.....	.....	.....	.....
1887	Windfalls	1,363	.....	.....	.....	.....
1888	Final cutting, thinning.....	7,759	11,717	.....	.....	.....
1888	Planting.....	.....	.....	1.7	.....	.....
1888	Windfalls	82	.....	.....	.....	.....
1889	Dry wood, windfalls.....	649	.....	.....	.....	.....
1889	Planting.....	.....	.....	2.2	.....	.....
1890	Windfalls	693	.....	.....	.....	.....
1890	Planting.....	.....	.....	.1	.....	.....
1891	Planting.....	.....	.....	.2	.....	.....
1892	Planting.....	.....	.....	.1	.....	.....
1893	Planting.....	.....	.....	.1	.....	.....
	Total.....	33,084	12,549	4.4	.....	.....

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